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Research Publications of the University of Minnesota

Bibliographical Series

No. 3

RESEARCH IN PROGRESS AT THE  
UNIVERSITY OF MINNESOTA  
JULY 1924 - JULY 1925

COMPILED BY

CLARENCE M. JACKSON, M.S., M.D., LL.D.  
Director of the Department of Anatomy in the University of Minnesota



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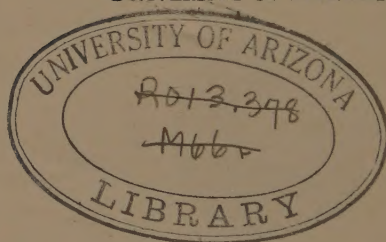


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## PREFACE

Since research work is recognized as a primary function of the University of Minnesota, it is desirable to have full information concerning the amount and character of the investigations in progress. The annual reports of the president contain merely brief accounts of the work at the experiment stations and lists of the publications by the members of the faculties. While highly desirable, these lists give very inadequate indications of the character of the investigations and do not include the research work by students, or the unpublished work in progress.

The purpose of the Graduate School in preparing the present bulletin is to give somewhat more complete data for the research work in the University during the past year (July 1, 1924, to June 30, 1925). The members of the faculties were accordingly requested to furnish information as to the original work by themselves and their students. This includes the work completed and published during this period, as well as unfinished work still in progress. Abstracts of each topic were requested, giving a brief indication of the purpose of the study, the methods and materials used, and the results (so far as available). The writer is deeply indebted to all those who so kindly co-operated in the collection and preparation of the desired information. The data are grouped under the corresponding undergraduate colleges. The Mayo Foundation, however, is a purely graduate organization. Indeed, in most cases the work and workers listed represent the staff and students of the Graduate School.

While every effort has been made to render the report complete and accurate, certain deficiencies should be pointed out. Some investigations have doubtless been overlooked. In some cases (especially in most of the studies from the Mayo Foundation) abstracts were not furnished, and merely the titles are available. In other cases, the abstracts furnished were too extensive and required abbreviation, which is sometimes unsatisfactory. In general the length of the abstract does not indicate the relative value of the contribution. Some of the studies should doubtless be classified as expositions of existing knowledge, rather than original research, but it is difficult to draw the line of demarcation. In spite of these defects, it is hoped that the results will be of interest, not merely as an indication of the relative activity of the various individuals and departments, but also as a cross-section of the productive scholarship at the University.

C. M. JACKSON.



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# THE COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

## ADMINISTRATION

JOHN B. JOHNSTON, Ph.D., Dean of the College of Science, Literature,  
and the Arts.

### 1. Investigation of the Means of Estimating Ability and Aptitude for College and Professional Work.

Two studies on this subject have been published:

(a) Tests for Ability before College Entrance. *School and Society*, 17:345-53.  
1922.

(b) Predicting Success or Failure in College at the Time of Entrance. *Ibid.*,  
Vol. 19, June 28 and July 5, 1924.

Further work is in progress.

### 2. A Study of the Antecedents of Students Who Fail in College and Comparison with Those of Students Who Succeed.

The study of occupations, education, birthplace, and other facts regarding the  
parents of students has been begun. To this will be added a study of extra-scholastic  
training and experience.

### 3. A Study of the Causes of Failure.

An investigation of students whose previous record in school and whose college  
ability test scores give expectation of success in so far as any factors appear which  
bear upon the possibility of predicting success or failure.

### 4. A Study of the Present Methods of Teaching and Organization of College Work.

The subject is being studied in relation to the full development of the powers  
of superior students. Collection of data on this subject has been begun in connection  
with the honors examinations.

## ANIMAL BIOLOGY

HAL DOWNEY, Ph.D., Professor of Histology.

### 1. The "Myeloblast."

The purpose was to determine the occurrence of the myeloblast in normal human  
and mammalian hematopoietic tissues, and to work out its origin and relationship to  
other blood cells under normal conditions and in cases of leukemia. The material  
used consisted of blood smears and sections of normal, experimental, and pathologic  
blood-forming organs and tissues.

The general conclusions have already been published in the form of a preliminary  
report entitled The Occurrence and Significance of the Myeloblast under Normal and  
Pathologic Conditions, *Archives of Internal Medicine*, 33:301-13. 1924. Work on the  
problem has been continued with the use of much additional material. The most im-  
portant conclusions are: Normally the myeloblast is found only in the bone marrow,  
where it serves as a mother cell for the granular leukocytes and red cells. In cases  
of lymphatic leukemia it occurs also in lymph nodes, including their follicles and germ  
centers, and in the blood. Its presence in lymph nodes is explained by dedifferentiation  
of the lymphocytes and by derivation of cells from the connective tissue which fail to  
differentiate.

2. See also the studies by I. A. Epstein, Ruth Graham, R. G. Koester, and C. H. Watkins.

ELMER LUND, Ph.D., Associate Professor of Animal Biology.

1. Experimental Control of Organic Polarity by the Electric Current: V. The Nature of the Control of Organic Polarity by the Electric Current. *Journal of Experimental Zoology*, 41. January, 1925.

2. The Effect of a Constant Magnetic Field on Morphogenetic Processes. *Proceedings of the Society for Experimental Biology and Medicine*, 22:125-26. 1924.

3. (With G. A. Logan.) The Relation of the Stability of Protoplasmic Films in *Noctiluca* to the Duration and Intensity of an Applied Electric Potential. *Journal of General Physiology*, 7:461-71. 1925.

DWIGHT E. MINNICH, Ph.D., Associate Professor of Animal Biology.

1. The Reactions of the Larvae of *Vanessa Antiopa* Linn. to Sounds. (In press.)

The larval instars of the mourning cloak butterfly, *Vanessa antiopa* Linn, respond to sound and mechanical stimuli by throwing the anterior third of the body dorsally or dorso-laterally with a rapid jerk. The responsiveness to sounds greatly increases with age while that to ordinary forms of mechanical stimulation greatly decreases. Decapitated bodies and fragments of bodies will respond to sound stimuli indicating a wide distribution of the sense organs concerned and the segmental nature of the response. The organs of sound perception are, in all probability, certain of the hairs located chiefly in the anterior two thirds of the body. This conclusion is based on experimental evidence obtained from larvae in which the hairs were: (1) partially destroyed by singeing; (2) heavily loaded with water droplets or flour grains; (3) rendered functionless during moulting.

The upper threshold for response to tones is about C" (1024 v/s) for full-grown larvae. A continuous air current inhibits the response to sounds. To short sound stimuli at intervals of five seconds, the animals do not fatigue readily, but with continuous stimulation fatigue brings about a cessation of response in from five to sixty seconds.

## 2. The Chemical Senses of Blow Flies.

Using methods similar to those previously employed by the author with Lepidoptera, it has been possible to demonstrate that the tarsi of a common species of black blow fly possess contact chemoreceptors which function as organs of taste. If after an appropriate period of inanition the tarsi of a fly are brought in contact with paraffin oil, the response is 25 per cent or less, while the response to distilled water is 100 per cent. After the administration of distilled water, however, the response to this stimulus shortly drops to 0 per cent. If now the fly is tested to 1M saccharose the response is 100 per cent. The feeding of 1M saccharose diminishes the per cent of response to it somewhat, but does not reduce it to zero. The tip of the proboscis also bears organs of taste which are even more sensitive than those of the tarsi. Organs of taste in the blow fly, therefore, occur on the tarsi and the tip of the proboscis. Further work is under way to map out completely the chemical senses of this form, including (a) experimental investigation of the sense of hearing in insects; (b) reactions of lower animals to light; (c) the inheritance of somatic acquirements in certain invertebrates.



JOHN A. CEDERSTROM, Ph.B., Instructor in Animal Biology.

A Study of the Objective Examination in Animal Biology.

The problem is to determine the reliability of the objective examination as a measure of achievement and how results correlate with final grades and previous records of achievement, and with the intelligence ratings as determined by the intelligence tests given entering freshmen; also what the students' reaction to this type of examination might be. The study shows a correlation of .85 between the objective examination and the final grade. The latter is a composite or average of four factors: (1) the average of the ten-minute quizzes; (2) the laboratory grade; (3) the mid-quarter grade; (4) the final examination.

The present study seems to indicate that the sciences may involve abilities that are not measured by the intelligence tests taken by incoming freshmen of the University of Minnesota. If so, there is needed a mental test to measure more adequately what students are able to do in sciences before we can predict their achievement in these subjects.

ADOLPH R. RINGOEN, Ph.D., Instructor in Animal Biology.

The So-Called "Hemohistioblasts" of Ferrata.

The purpose of the problem was to determine the origin and nature of the Ferrata cells. The material used consisted of stained blood smears from myelogenous leukemic patients, and fresh leukemic preparations (brilliant cresyl blues). Rabbit marrow and lymph node smears were used for comparative purposes. *Conclusions:* Substantial evidence shows that Ferrata's so-called "hemohistioblasts" can not possibly be interpreted as histoid elements, but that they are damaged blood cells of various types.

IRWIN A. EPSTEIN, D.D.S., Assistant in Dentistry, University Hospital.

A Study of the Blood in Cases with Dental Infection. (Under the direction of Hal Downey.)

The work includes hemoglobin determinations, erythrocyte and leukocyte counts, and a thorough study of the morphology of the leukocytes. This will include a biometric check for normal blood. Other types of infection will be used in order to determine whether a specific blood change is associated with dental infection. This work is being aided by a grant from the Scientific and Research Foundation of the National Dental Association. It has not progressed sufficiently to warrant conclusions.

RUTH G. KOESTER, Undergraduate Student, Assistant in Animal Biology.

Changes in Blood Vessels That Have Been Ligated for Various Periods of Time. (Under the direction of Hal Downey.)

Normal adult rabbits were used for these experiments, and their arteries were ligated for periods of time varying from five to thirty days. A careful study is now being made of the changes which take place in the different regions of the arterial wall. The work is not sufficiently advanced to justify final conclusions.

CLAUDE LEIST, M.A., Assistant in Animal Biology.

Study of Cestodes Found in American Pike Perches. (W. A. Riley, Adviser.)

The specimens of cestodes were found in the intestine of the pike perches and were thought to be the adults of the genus *Triacnophorus*. This presented a problem of classification. Examination shows the specimens to be of the family *Diphyllobothriidae* and probably of the sub-family *Triacnophorinae*. The two points and size of the hooks together with the size of the specimens seems to point to a new species, perhaps of the genus *Triacnophorus*, or to a closely allied one.

HUGH E. WALLACE, M.S., Assistant in Animal Biology.

Animal Parasites in the Blattidae. (Thesis for the M.S. degree; W. A. Riley, Adviser.)

The purpose has been to summarize the previous work upon the animal parasites of cockroaches, and to determine the internal parasitic fauna of local cockroaches. It is a preliminary work to problems upon relation of the cockroach to human disease. Cockroaches were dissected and examined. A total of seven species of Protozoa and three species of helminths have been found, chiefly in the large cockroach, *Periplaneta americana*. Descriptions are given of each parasite that has been recorded, and a more detailed discussion is given to the forms found locally. No new species of parasites are described.

CHARLES H. WATKINS, M.A., Teaching Fellow in Anatomy.

The Reactions of the Various Cellular Elements of the Omentum and of the Subcutaneous Connective Tissue in Aseptic Inflammation. (Under the direction of Hal Downey.)

This study is designed to determine the changes in the various cellular elements of the omentum and subcutaneous tissue and to ascertain the origin of the free cells in these tissues. A series of rabbits was used for this experiment. The inflammatory reaction was produced in the omentum by placing the rabbit's own spleen or the spleen of a white rat into a fold of the omentum. The reaction was also produced in the subcutaneous tissue by placing small particles of spleen into the subcutaneous tissue of the back. The work is still in progress.

RUTH GRAHAM, Undergraduate Student.

A Microscopic Study of the Tissues Involved in Hodgkin's Disease, with Special Reference to the Origin and Development of the Dorothy Reed Cells. (Under the direction of Hal Downey.)

A comparison of tissue changes in Hodgkin's disease with those of aseptic inflammation. The material used includes microscopic sections of tissues and organs from cases of Hodgkin's disease, and normal and experimental animal tissues used for comparison. *Conclusion:* In the lymph nodes, the Dorothy Reed cells arise from the reticular cells.

## ANTHROPOLOGY

EVELYN LEGGO, Undergraduate Student.

The Education of the Primitive Child. (Under the direction of W. D. Wallis.)

The purpose of the study is to discover the manner in which the primitive child is trained to assume the responsibilities of adult life, both as an individual and as a member of the group to which he belongs. The information is obtained from books and periodicals. *Conclusions:* The school as a specific institution does not exist in primitive society. Education is carried on in the home, fields, clubhouses, lodges, and "temples." Play and example and imitation are the earliest educative forces in the life of primitive children. The basis of moral and technical education is imitation of the work and habits of the parents.

## ASTRONOMY

WILLIAM O. BEAL, M.A., M.S., Instructor in Astronomy.

The Motion of Hyperion. (To be offered as a thesis for the Ph.D. degree.)

The purpose is to obtain more accurate tables of the inequalities in Hyperion's motion. This constitutes an extension of the work done by the late G. W. Hill. The method is that of period orbits. Mechanical quadrature.

## BOTANY

J. ARTHUR HARRIS, Ph.D., Professor of Botany and Head of the Department of Botany.

1. (With Z. W. Lawrence, W. F. Hoffman, J. V. Lawrence, and A. T. Valentine.) The Tissue Fluids of Egyptian and Upland Cottons and Their  $F_1$  Hybrid. *Journal of Agricultural Research*, 27:267-328. 1924.

A demonstration of the differentiation of agricultural varieties of Egyptian and Upland types of cotton with respect to such physicochemical properties of their leaf tissue fluids as osmotic concentration, specific electrical conductivity and hydrogen ion concentration, and the behavior of these properties in the  $F_1$  hybrid. Results reported are for experiments made at Sacaton, Arizona, in 1921. Experiments have been continued annually since that time, and have dealt with other varieties and other hybrid generations, the results of which will be published shortly.

2. (With J. V. Lawrence.) Tests of a Wet Oxidation and Modified Volhard Method for the Determination of Chlorides in Plant Tissue Fluids. *Journal of the American Chemical Society*, 46:1471-77. 1924.

The development of a practicable and accurate method for determining the concentration of chlorides in plant tissue fluids.

3. On the Relationship between Stature and Length of Appendages in Man. *American Naturalist*, 58:254-71. 1924.

A biometric study of the relationship between stature and the relative length of the anterior and posterior appendages in man.

4. The Tissue Fluids of *Cuscuta*. *Bulletin of the Torrey Botanical Club*, 51:127-31. 1924.

The osmotic concentration of the tissue fluids of *Cuscuta*, unlike those of parasitic *Loranthaceae*, is not necessarily higher than that of the host plant in the case of parasitism on an extreme halophyte.

5. (With R. A. Gortner, W. F. Hoffman, J. V. Lawrence, and A. T. Valentine.) The Osmotic Concentration, Specific Electrical Conductivity and Chloride Content of the Tissue Fluids of the Indicator Plants of the Vegetation of the Tooele Valley, Utah. *Journal of Agricultural Research*, 27:893-924. 1924.

A study of the tissue fluid properties of the types of vegetation which have been found to be characteristic of different types of land indicates that these types differ in the fundamental physicochemical properties of their leaf tissue fluids.

6. (With J. V. Lawrence and Z. W. Lawrence.) The Chloride Content of the Leaf Tissue Fluids of Egyptian and Upland Cotton. *Journal of Agricultural Research*, 28:695-704. 1924.

Demonstration that the Egyptian and Upland types of cotton are differentiated with respect to their capacity for the absorption and retention in solution of chlorides, the Egyptian type being characterized by a far higher chloride content than the Upland type of cotton.

7. (With W. F. Hoffman and A. H. Johnson.) The Reaction of the Cotton Plant. *Science*, n.s., 61:65. 1925.

Criticizes conclusions based on superficial moisture, and shows that the reaction of the tissue fluids of the cotton plant is well on the acid side of neutrality.

8. The Accumulation of Chlorides in the Leaf Tissue Fluids of Egyptian Cotton with the March of the Season. *Proceedings of the Society for Experimental Biology and Medicine*, 22:415-17. 1925.

Indicates a more rapid rate of accumulation of chlorides in the Egyptian than in the Upland types of cotton.

9. Activities of the Department of Botany, University of Minnesota, 1924. Minneapolis, Minnesota, 1925. 29 pages.

A review of the work of the Department of Botany for the calendar year 1924, including the research work in progress.

10. (With W. F. Hoffman and J. V. Lawrence.) Differential Absorption of Anions by Varieties of Cotton. *Proceedings of the Society for Experimental Biology and Medicine*, 22:350-52. 1925.

Demonstrates that the absorption of anions by Egyptian and Upland type is differential, the Egyptian type absorbing larger quantities of chlorides and the Upland type absorbing larger quantities of sulphates.

11. The Distribution of the Magnitudes of the Inter-mensual Correlation Coefficient for Egg Production in the First Two Laying Years in the Domestic Fowl. (In press.)

This investigation, which is one of a series of biometric studies on the physiology of fertility in the domestic fowl, deals with the problem of the distribution of the magnitudes of the correlation between the productions of the various months of the first twenty-four months of the period in which the bird may be expected to lay. The results show that the intra-annual inter-mensual correlations for the first and second years are of about the same order of magnitude. They demonstrate that the distribution of the magnitudes of these correlations over the first two years of the bird's life is an orderly one but characterized by rhythmic changes. The results extend previously formulated laws by showing that there is a tendency for the highest values of the correlation coefficient to fall upon homologous months in the different years of the bird's life.

12. (With T. L. Connors, A. T. Elders, and L. E. Kirk.) On the Regression of Soil Properties and Crop Characters in Associated Plots of an Experimental Field. (In press.)

In an earlier paper the writer proposed a coefficient of substratum heterogeneity to be employed in measuring the irregularities of an agronomic experimental field. This coefficient has been rather widely used, and it has seemed desirable to provide further tests of its statistical validity as practically applied. The present study shows that such measures of the soil characters as electric resistance and such characteristics of the plant as osmotic concentration, specific electrical conductivity, ratio of conductivity to freezing point depression, and chloride content of the leaf tissue fluids show practically linear regression between associated plots.

13. A Table to Facilitate Correction for Undercooling in Cryoscopic Work. (In press.)

An aid to the calculation of the correction for undercooling in the determination of osmotic concentration.

14. (With C. T. Hoffman and W. F. Hoffman.) The Sulphate Content of the Leaf Tissue Fluids of Egyptian and Upland Cotton. (In press.)

Extensive series of analyses demonstrating that the concentration of sulphates is higher in the tissue fluids of Upland cotton than in those of Egyptian cotton grown under identical conditions.



15. (With J. V. Lawrence.) A Practical Method for the Determination of the Chloride Content of Plant Tissue Fluids. (In press.)

A description of a practical method of the determination of chlorides for the use of ecologists.

16. Correlation and Machine Calculation. (In press.)

Review of the method of computing correlation from moments and product moments taken at zero as origin, which is the essential requisite for the use of modern computing machinery in determining the coefficient of correlation.

17. Variation and Correlation in the Inflorescence of *Manfreda virginica*. (In press.)

The paper is one of a series of investigations on the physiology of fertility and fecundity in plants. A detailed investigation of variation in number of flowers, number of roots formed, and number of seeds matured per locule and per fruit in the inflorescence of *Manfreda* and of the correlation between all of these characters.

18. The Relationship between the Concentration of the Soil Solution and the Physicochemical Properties of the Leaf Tissue Fluids of Egyptian and Upland Cotton. (In press.)

The investigation has two phases (a) that of heterogeneity of the field with respect to soil properties and (b) that of the correlation between the electrical resistance of the soil and the osmotic concentration, specific electrical conductivity, and chloride content of the leaf tissue fluids of cotton grown upon it. The closeness of the correlations between soil properties and plant characteristics demonstrated shows the remarkable intimacy of the relationship between the characteristics of the plant and the properties of the soil and indicates that many physiological investigations may be transferred from the laboratory to the field.

19. See also the study by W. P. Covell.

CARL O. ROSENDAHL, Ph.D., Professor of Botany.

1. Observations on the Embryo-Sac Development and Embryology of *Calla Palustris*.

For the most part the embryo-sac development conforms to the usual angiospermous type, but there are occasional interesting deviations from the normal course. In these cases two or more megaspores germinate, giving rise to several two-, four-, or even eight-celled embryo-sacs. Fertilization of eggs in the accessory embryo-sacs has not been observed. On the other hand double ovules sometimes occur in which embryos develop. The embryo develops a short massive suspensor, similar to that which is characteristic of many lower dicotyledons. The tendency for more than one megaspore to germinate suggests affinity with *Peperomia* where this condition is common and supports the theory in regard to the origin of the Arioids from the Piperales.

2. (With F. K. Butters.) Studies on the Vegetation of Minnesota.  
I. Revision of the Trees and Shrubs of Minnesota.

A complete taxonomic revision of all the groups treated in the first edition is being carried out. More exact and fuller information regarding the geographical distribution of the species is being incorporated as a result of field observations carried on since the first edition appeared. The original brief survey of the vegetation areas of the state has been amplified.

### 3. Revision of the Genus *Sullivantia*.

A study of the genus *Sullivantia* has brought out the fact that the form limited to the "Driftless Area" of Wisconsin, Minnesota, Iowa, and Illinois is a distinct and hitherto undescribed species. It was formerly referred to *Sullivantia Sullivantii* of Ohio and Indiana and later transferred to *S. Hapemani*, a species of the Big Horn Mountains of Wyoming. Another form, occurring in west central Colorado and at first described as a species of another genus (*Boykinia Purpusi*) has likewise been referred to the Wyoming species but this also turns out to be distinct. There are accordingly six species in the genus, distributed from Ohio to Oregon, but each one occupies a relatively small and isolated geographical area. This genus offers good evidence for the origin of species through geographical isolation.

### 4. The Hayfever Plants of Minnesota.

A study of the hayfever plants of the state has been in progress for several years. This shows that there are approximately 450 species of potential hay fever plants in Minnesota. Many of these can be eliminated on account of infrequent or scattering occurrence and the list can be reduced to about 200 species which must be considered as frequent causative agents. These have been classified according to seasons and natural relationships. Observations on the time of blossoming of all the species is given and the geographical ranges of the most important ones have been mapped. Pollen has been collected from a considerable number and tests are being carried out to determine which ones give positive reactions.

5. The Distribution of the White Oak in Minnesota. (See abstract under F. K. Butters.)

6. See also the study by E. S. Horton.

JOSEPHINE E. TILDEN, M.S., Professor of Botany.

Researches on the Taxonomy, Geographic Distribution, and Biology of the Algae.

Comprehensive studies on the classification, geographic distribution, and general biological relations of the algae have been under way for the past many years. As an essential for other work on these problems, and particularly on the second, a comprehensive assembling of the literature has been undertaken. This has been issued in card form under the title, *Index Algarum Universalis*, of which more than nineteen thousand cards have been issued.

During the past four years attention has been given to the problem of the economic value of the algae as the ultimate organic source of iodine and of the vitamins of marine origin, both now recognized as of the greatest importance in human metabolism, and as the ultimate source of the food of economically important marine organisms. The results of field operations in Hawaii during the past summer and critical study of the contents of the digestive tracts of important marine food fishes indicate that a definite beginning has been made in an important field of investigation.

FREDERIC K. BUTTERS, Ph.D., Associate Professor of Botany.

1. (With C. O. Rosendahl.) The Distribution of the White Oak in Minnesota. *Minnesota Studies in Plant Science*, pp. 199-209. 1924.

The distribution of the white oak is found to be due partly to climatic factors, partly to soil factors. It never occurs spontaneously on calcareous soils, and experiments show that seedlings are unable to develop normally in sand to which five per cent of chalk has been added. This explains the peculiar local distribution of a very characteristic type of Minnesota woodlands.

2. Notes on the Range of *Maianthemum canadense* and Its Variety *interius*.

In 1914 M. L. Fernald described a new variety of this species. At that time it appeared that the two varieties were, the one eastern, the other western. Collections during the past ten years have shown that both varieties occur throughout the region of the Great Lakes from New York to Minnesota, but that the typical form at least in the west, is a more northern plant, a denizen of the evergreen forests, while Fernald's variety, *Maianthemum canadense* var. *interius* is a plant of the deciduous forests.

3. The Basis of Specific and Varietal Distinctions in the Genus *Maianthemum*.

In connection with the study of the range of the two varieties of *M. canadense* it became necessary to evaluate the differences between these forms. It has been found that in the western part of their range they behave like true species while in the eastern part of their range they completely intergrade. This has led to an attempt to evaluate the taxonomic criteria throughout the genus. It appears that there are three valid species, one in Europe, one in eastern Asia and Western North America, and one in eastern North America. The last mentioned has several varietal forms, one of which will be described as new.

4. Studies on Vegetation of Minnesota. (See abstract under C. O. Rosendahl.)

5. Work on the Taxonomy and Plant Geography of the Higher Mountains of British Columbia.

In past years numerous collections have been made chiefly from the Selkirk Mountains. Critical study of these collections continues, and the collections have been added to, to a slight extent. During the year the genus *Carex* was studied somewhat intensively.

RODNEY B. HARVEY, Ph.D., Associate Professor of Botany.

Physiological Investigations. Enzymes of Thermal Algae. *Science*, 60:481-82. 1924.

Experiments on the influence of continuous artificial illumination on various plant activities, including flowering, the carrying of seedlings over the critical period of reserve food exhaustion and its relation to resistance to fungus attack, have been carried on. Observations on the enzymes of thermal algae were made during a visit to Yellowstone Park.

WILLIAM S. COOPER, Ph.D., Assistant Professor of Botany.

1. An Apparatus for Photographic Recording of Quadrats. *Journal of Ecology*, 12:317-21. 1924.

Description of a portable apparatus by which vertical photographs of small areas of vegetation may be made.

2. Vegetational Development upon Alluvial Fans in the Vicinity of Palo Alto, California. To be published in *Ecology*.

A study of the relation of vegetational development to the physiographic process of fan building. A detailed investigation of the distribution of the present vegetation is involved, and a reconstruction, from historical and other sources, of the vegetation before its alteration by cultural operations. Modifications of some of the current concepts of plant succession is suggested.

### 3. The Fundamentals of Vegetational Change. To be published in *Ecology*.

A general paper, proposing reconstruction of the foundations of the science of dynamic ecology. A historical survey is followed by a statement of the concept that succession is the unbroken stream of vegetational development, originating with the appearance of the first plants upon the earth. The vegetation of to-day constitutes the advancing front of this stream. All types of vegetational change must be considered successional. The stream is governed and directed by interaction of forces residing in the vegetation itself and in the environment. Finally, the new concept is reconciled with current ecological theory, with such modifications of the latter as is necessary.

### 4. The Sand Dunes of the Pacific Coast and Their Vegetation.

This work, which has been in progress for some time, has been advanced during the present year mainly through exploration covering the southern half of the California coast. An expedition was made also to the Sonoran shore of the Gulf of California. Continuation of intensive study of vegetation and environmental factors is in progress in the Monterey region.

### 5. (With H. George.) A Study of Post-Glacial Plant Remains.

In the spring of 1923, an excavation south of Loring Park, Minneapolis, revealed a layer, of some considerable extent, of plant remains in an excellent state of preservation. The trench from which the remains were taken was some twelve feet below the original surface and the thickness of the layer approximately eight feet. The formation is postglacial, it is believed, and is from ten to fourteen thousand years old. The plant remains indicate a well-developed spruce forest together with considerable amount of peat. The forest was probably situated on the edge of a lake to the east and was later buried by material from a rise of ground to the west. The part of the work carried on this year is the separation and identification of the plant remains. It will be completed next year by the study of deposits in other places.

WALTER P. COVELL, M.S., Teaching Fellow in Anatomy.

#### 1. Variations and Correlations on the Diameters of the Heads of New-born Infants. (Under the direction of J. Arthur Harris.)

The purpose is to determine the amount of variation and correlation between the diameters of the head, the length of the body, and the weight of the body. Measurements of 3,600 newborn infants comprise the material for a statistical study. The means of the occipitofrontal and biparietal diameters are slightly less in the case of the female. The coefficients of variability are greater for the biparietal diameters. The occipitofrontal diameter is more highly correlated with body length and body weight. Body weight and the occipitofrontal diameter show a higher correlation than any of the other measurements.

#### 2. See also studies listed under the Department of Anatomy, Medical School.

HARRIET GEORGE, M.A., Assistant in Botany.

The Plant Succession of the Flood Plain of the Mississippi River with Special Reference to the Pioneer Stage. Read before the Ecological Society of America, December, 1924. (Thesis for M.A. degree; W. S. Cooper, Adviser.)

A study of the flood plain of the Mississippi River was first undertaken in the fall of 1921, to determine the succession of plants with relation to the habitat features and in order to study, especially, the behavior of the cottonwood, various species of



which are important pioneers in such places throughout the country. The work has been carried on largely in the field, the vegetation being determined by observation and quadrat studies. Various habitat determinations have been supplemented by laboratory experiments and a large number of photographic studies. Work continued during the present year.

2. A Study of Post-Glacial Plant Remains. (See abstract under W. S. Cooper.)

ETHEL S. HORTON, M.A., Assistant in Botany.

A Problem in Cytology in Genetics of a Wheat Species Cross. (Under the direction of C. O. Rosendahl, H. K. Hayes, and Fred Griffec.)

The purpose of the problem is to determine the behavior of the chromosomes in a cross between Marquis and Iumillo, a durum wheat, and what relation this bears, if any, to rust resistance. Chromosome numbers, cytological abnormalities, and, possibly, pollen size are to be correlated with ear type and rust resistance. The work was begun too recently to have reached any results.

GERALD A. VACHA, B.S., Assistant in Plant Physiology.

Effects of Chemicals on Plant Tissues. (Thesis for the M.S. degree; under the direction of W. H. Alderman and R. B. Harvey.)

An attempt to preserve natural color in fruits, vegetables, farm crops, and other plants. It is not possible to state in a brief report all the materials used. Up to date 97 different formulas, which consist of various mixtures of chemical compounds, have been employed. Plant materials used include plums (standard varieties), apples, crab apples, pears, peaches, lemons, oranges, grapes (purple, white, and red varieties), blueberries, raspberries (red, black, and yellow), blackberries, strawberries, gooseberries, currants, cranberries, cherries, Italian prunes, vegetables of various kinds; the common grain crops and grasses, leaves of ornamental trees, shrubs, and, to a limited extent, flowers. Very satisfactory results have been obtained and it is possible by the use of these various formulas to preserve natural colors in the above mentioned plant materials for exhibition, classroom, and museum purposes.

The second problem, in progress, is a study of the red raspberry so as to determine the proper running methods, based on plant nutrition. A third problem is that of changing the polarity of cells in hardwood cutting by the use of weak electric currents. So far only negative results have been obtained.

RAYMOND H. WALLACE, B.A., Assistant in Botany.

The Effect of Some Unsaturated Hydrocarbons upon Plant Tissues.

Experiments have shown that *Coleus* plants can be stimulated to produce aerial roots near the apex of the plants by exposing them to small concentrations of illuminating gas. An attempt to develop roots on woody-stemmed plants such as apple, plum, and cherry, by ethylene, a constituent of illuminating gas, was without success, but a much more striking reaction was secured. Dormant apple buds were completely destroyed by excessive cell division on exposure. Cells were completely dedifferentiated. Within a few days this proliferation had spread to the highly complex cortical and phloem tissues of the nodes and internodes, without further exposure to gas. Of the thirty kinds of woody-stemmed trees and shrubs in the dormant winter condition which have been used, approximately fifty per cent show this reaction, which may vary from only a slight proliferation as in the case of butternut to almost complete destruction of the tissue as in the case of apple, willow, cottonwood, and others. Not a single reaction has been obtained with twenty-five woody-stemmed greenhouse plants. A preliminary cytological study of the tissues shows mitotic cell division. It also shows that almost any cell of the phloem and cortical region can be stimulated to cell division.



## COMPARATIVE LITERATURE

DORIS A. STEVENS, M.A., Instructor in University High School.

A Comparison of the Character of Marianne in Marivaux's *Vie de Marianne* and of Clarissa Harlowe in Richardson's *Clarissa Harlowe* as French and English Types Respectively. (Thesis for the M.A. degree; O. W. Firkins, Adviser.)

ALBERTA P. CORAM, B.A., Graduate Student.

Comparison of the Supernatural in the Work of Edgar Allan Poe and Theophile Gautier. (Thesis for the M.A. degree; O. W. Firkins, Adviser.)

## COMPARATIVE PHILOLOGY

FREDERICK KLAEBER, Ph.D., Professor of Comparative and English Philology.

## 1. Language-Rivalry and Race-Mixture.

The mingling of two peoples speaking different languages is liable to lead to the disappearance of one of the languages. History abounds in illustrations of this process. The co-existence, at present, of different languages in the same area—e.g., of English and Dutch (in addition to other European and the native languages) in South Africa, of Czech and German in Bohemia, of German and Italian in South Tirol, etc.—furnishes important material for study. Is it possible to formulate "laws" determining the result of such competition? What is the effect of linguistic rivalry on the surviving language? How far is the use of the term "mixed language" justified? These are some of the problems calling for an answer. The views held by von der Gabelentz, Schuchardt, Windisch, Paul, Hempl, Morf, Jespersen, and other scholars have been duly examined. A comprehensive survey is now attempted in the light of a larger number of historical and present day cases. The bearing of this study on our notions concerning the origin and spread of the old Indo-European languages is to be kept in mind.

2. New Textual and Interpretational Studies of *Beowulf*.

There is still uncertainty concerning the exact meaning of a large number of passages in the poem of *Beowulf*. In recent years Professor Ernst A. Kock, of the University of Lund, and other scholars have written extensively on the subject and have raised new and old questions relating to the status of the manuscript (interpolations, etc.) and, especially, to the proper interpretation of doubtful passages. This makes it necessary to go carefully over the ground again with a view to arriving, if possible, at a definitive solution of the major part of the disputed points. The comparative method used in dealing with questions of syntax and style promises to yield adequate results. The important inquiry into classical influences (Vergil) can now be taken up with a fair degree of confidence. Also possible allusions to contemporary history are discussed.

3. A Note on *The Battle of Brunanburh*. To be published in the *Festschrift für Alois Brandl*, in June, 1925.

The Book of Joshua is shown to be one of the sources from which the poet drew inspiration for his version of the victory of Brunanburh (gained by King Ethelstan in 937 A.D.). The author appears to be a gifted and well-trained publicist of the West Saxon court, whose choice phraseology—much of it borrowed—is apt to conceal the poverty of genuine heroic feeling. His poem should not be considered a fair specimen of Anglo-Saxon, or Old Germanic, poetry of the heroic order.

## 4. See also the following study by L. G. Frary.

LOUISE G. FRARY, M.A., Graduate Student.

Studies in the Syntax of the Passive in the Old Germanic Dialects, with Especial Reference to the Use of *Wesan* and *Weordan* in Old English. (Thesis for the Ph.D. degree; under the direction of F. Klaeber.)

After a general sketch of the various devices adopted in the old Germanic dialects for the expression of the passive relation, the particularly complicated conditions in the Old English are examined in detail. Neither the comparison of the Old English passive forms with the traditional Latin system nor their interpretation on the basis of the distinction between aspects (so-called "Aktionsarten") of verbs is found to furnish a sufficient explanation of the actual facts. The greatly varying uses in different texts and in apparently similar passages receive new light by a consideration of certain stylistic tendencies which lend color and individuality to the employment of syntactical forms. All the important texts of Old English prose and poetry have been carefully studied with reference to the treatment of the passive. It appears that, contrary to the current conception, the use of *weard* is decidedly on the increase toward the end of the Old English period. The complete and seemingly abrupt change of system that took place in the Middle English period is illustrated from representative texts, and an explanation of this phenomena will be suggested.

## ENGLISH

JOSEPH W. BEACH, Ph.D., Professor of English.

1. Expostulation and Reply. *Publications of the Modern Language Association of America*, 40:346-61. 1925.

A reply to the article by Professor Barry Cerf, in the *Publications of the Modern Language Association of America* for December, 1922, in which he attacks Wordsworth's philosophy of nature as being unsound and containing anti-moral and anti-religious tendencies. The purpose is to correct the false impressions of Wordsworth given by Professor Cerf and other critics. A study in the light of common sense, of a large body of Wordsworth's poems, and in particular of *The Prelude* and of certain shorter poems dating from 1798, including that entitled *Expostulation and Reply*. It shows that Wordsworth's philosophy of nature is not anti-rational or anti-moral, particularly in its main tendency.

2. See also the study by Elizabeth Gile.

ELMER E. STOLL, Ph.D., Professor of English.

1. Drama, Old and New. *Modern Language Review*, April, 1925.

2. Shakespeare Studies.

A book; finished, but not yet published.

CECIL A. MOORE, Ph.D., Associate Professor of English.

1. Whig Panegyric, 1700-1760. A Phase of Sentimentalism. To be published in the *Publications of the Modern Language Association of America*.

As the title indicates, it is a comparative study in political and literary ideals.

2. John Dunton, Pietist and Impostor. To be published in *Studies in Philology* (University of North Carolina), July, 1925.

This is a study of a book-dealer and writer of the late seventeenth and the early eighteenth century who has long been known as somewhat slippery; but the full measure

of his iniquity has not been investigated. It is shown that nearly all of his pious lucubrations were plagiarized from obscure writers in the first half of the seventeenth century.

3. English Spleen and Romantic Melancholy. (Ready for publication.)

This is an attempt at a scientific explanation of the cult of melancholy in the eighteenth century, which most historians dismiss as a mere affectation. It involves a study of biography, popular literature, and various medical works of the time, such as Dr. Cheyne's *The English Malady*. The conclusion is that the graveyard school of poetry and the Gothic Romance are merely the literary expression of a pretty general psychopathic state.

4. Midnight Meditations 1646. A Bibliographical Puzzle. To be submitted to *Modern Language Notes*.

An attempt to straighten out errors in bibliographies, the Museum Catalogue, and elsewhere in connection with one of the great literary curiosities of the seventeenth century—errors arising from the failure of the bibliographers to identify three books as really one under different titles.

5. Minor Miltonians.

This is a description of eight rare works of the eighteenth century; the article is intended to supplement Professor Havens' book dealing with Milton's influence in this period.

6. A book dealing with certain phases of religious influence in English literature from the late fifteenth century to 1660. Almost completed.

7. See also the studies by E. G. Bahls, Ruth Christie, and Ethel Macmillan.

CORTLANDT VAN WINKLE, Ph.D., Assistant Professor of English.

*Epithalamion* of Edmund Spenser.

The tracing of the wedding literature to Spenser's time. The material was from Greek, Latin, neo-classic, and Byzantine poets and critics, using Spenser's text as a basis, together with a critique of the text. The conclusion reached is that there are two main currents of epithalamic poetry, Spenser's following the literary model of Catullus, with indebtedness to French and Italian writers, besides indebtedness to local customs and folklore.

MURIEL B. CARR, Ph.D., Assistant Professor of English.

Chaucer's *Pardoner's Tale*.

An article attacking certain current interpretations of Chaucer's *Pardoner's Tale*, and proposing alternative interpretations.

ELIZABETH ATKINS, Ph.D., Instructor in English.

Points of Contact between Socrates and Byron. To be published in the *Publications of the Modern Language Association*.

This advances the theory that Byron's Platonism was not an echo of Shelley's, as has formerly been supposed; but that Byron read the Platonic dialogues independently and was much influenced by the earlier ones, expressing Socrates' agnostic point of view.

WINSLOW H. LOVELAND, Ph.D., Instructor of English.

The "Mirrors" or "Specula" in English Literature of the Sixteenth Century. (A thesis for the Ph.D. degree.)

The purpose is to trace the development of a literary fashion from the medieval period to the Elizabethan Age, showing the number and types of works using the mirror title and motif. The material used included medieval documents, such as Migne's *Compendium* and Vincent de Beauvais' *Speculum*; *Mirror for Magistrates*, etc.

EMMA G. BAHLS, M.A., Graduate Student.

Growth in the Intellectual Interests of Samuel Richardson. (Thesis for the M.A. degree; C. A. Moore, Adviser.)

An attempt to find out what preparation the author of *Pamela* made for his later novels and how his studies affected his methods as a writer of fiction. Based chiefly on Richardson's correspondence, *Clarissa Harlowe*, and *Sir Charles Grandison*.

RUTH CHRISTIE, M.A., Graduate Student.

Comic Theory Developed in the First Half of the Eighteenth Century. (Thesis for the M.A. degree; C. A. Moore, Adviser.)

A study of classic origins and the application given these by such theorists and humorists as Addison and Fielding.

ELIZABETH GILE, M.A., Scholar in English.

The Technique of Authentication in the Novels of Joseph Conrad. (Thesis for the M.A. degree; J. W. Beach, Adviser.)

This study shows how the device of the story-teller and other devices for designating the sources of the author's knowledge of the facts presented create verisimilitude and the impression of elusiveness. The study has been limited to those novels which use conspicuous devices for quoting authorities for the facts and opinions presented. It includes a thorough analysis of the books which introduce the story-teller Marlow, viz., the short stories, *Youth* and *Heart of Darkness*, and the novels, *Lord Jim* and *Chance*; an outline of *Nostromo* and *Under Western Eyes*, novels in which the use of the story-teller is incidental; a detailed discussion of *Victory*, a novel which modifies the story-teller device; and an analysis of *The Arrow of Gold*, a novel based upon documentary evidence.

ALBERT G. GOUDE, M.A., Graduate Student.

The Effect of Tyndale's Translation on the King James Version. (Thesis for the M.A. degree; J. M. Thomas, Adviser.)

A survey was made of all versions, critical works, and allied subjects, to determine the influence of other translators. The texts of the two translations were compared for similarities in grammatical and rhetorical features. Examples of each type compose a large part of the thesis. It is concluded that the structures and style of the Authorized Version are Tyndale's creation. In the part corresponding to the Cologne Fragment, 87.56 per cent of the syntax is Tyndale's.

ETHEL MACMILLAN, M.A., Graduate Student.

The Plays of Isaac Bickerstaff. (Thesis for the M.A. degree; C. A. Moore, Adviser.)

HELEN SCURR, Ph.D., Graduate Student.

Henry Brooke. (Thesis for the Ph.D. degree, in press; C. A. Moore, Adviser.)



JEAN W. TAYLOR, B.A., Graduate Student.

The Relation of Henry Fielding's *Amelia* to His Earlier Works and the Social Conditions of the Time. (To be offered as a thesis for the M.A. degree; C. A. Moore, Adviser.)

## GEOGRAPHY

DARRELL H. DAVIS, Ph.D., Associate Professor of Geography and Head of the Department of Geography.

1. Urban Development in the Kentucky Mountains. *Annals of the Association of American Geographers*, Volume 15. 1925.

The existing literature, in the field of both serious contributions and fiction, conveys an erroneous idea as to present-day conditions in the Kentucky Mountains, due to the recent rapid change associated with the development of the coal resources of the area. Though urban development is still limited, the number of towns with populations of 1,000 or over represents practically average conditions for the state. Towns are in all cases located on main drainage lines in the area of creek bottom settlement, as lines of communication focus upon the principal valleys which also afford the only suitable city sites. In the area of ridge top settlement, the location of towns may be independent of drainage lines and closely related to rail routes which do not follow stream courses. For the area as a whole, the dominance of drainage lines in determining city sites has favored a marginal location for the larger foci of population.

2. The Changing Rôle of the Kentucky Mountains and the Passing of the Kentucky Mountaineer. *Journal of Geography*, 24:41-52. 1925.

The Kentucky Mountains represent a maturely dissected plateau, a maze of even crested ridges, generally heavily timbered and uninhabited. Valleys are narrow and agricultural land is limited in amount. Early settlement, which occurred at the time of occupation of central Kentucky, was in the larger valleys, but with the subsequent genetic increase of population, even the rougher country was occupied and practically all available land was brought into agricultural use. Early settlers were probably of the same stock that settled the Blue Grass, but in the mountains, living conditions are hard, hence deterioration began as soon as population commenced to press upon the limits of sustenance. Buildings, domestic conveniences, and farm implements reflect the limited agricultural opportunities of the area. To-day, however, the development of the coal resource has resulted in the superimposition of twentieth century industrialism upon this community of self-sufficing households. This has been accompanied by profound changes including the passing of much land from agricultural use, an influx of foreigners and negroes, and considerable urban development. In no other portion of Kentucky is change occurring with more rapidity, yet the metamorphosis which the next half century will witness has as yet only begun. With this change is passing one of the most picturesque figures in the field of American fiction, the Kentucky mountaineer.

3. Geography of the Kentucky Mountains. *Kentucky Geological Survey*, Series VI, Volume 18. 171 pages, with 80 photographs, maps, and diagrams. 1924.

Part One (27 pages) is devoted to a general discussion of the space relationships and physical characteristics of the Kentucky Mountains and a subdivision of the entire area into subregions on the basis of differences in the physical equipment and the character of the economic response.

Part Two is a detailed survey and explanation of the present regional economy in terms of the physical setting. As a result of this study, recommendations are made as to measures to be taken to insure the future of the area. These measures include: (1) diversification of agriculture; (2) improvement of roads; (3) encouragement of

reforestation; (4) regulation of coal mining; (5) enforcement of sanitary regulations; and (6) taxation on coal. The late development of eastern Kentucky allows the region to profit by the lessons of other areas whose resources have already been dissipated. A region of enormous mineral wealth, with a considerable remnant of the original forest resource, and with some land which can be kept permanently in agricultural use, there is no reason why the mountains should not have a promising future.

RICHARD HARTSHORNE, Ph.D., Instructor in Geography.

1. The Lake Traffic of Chicago. (Thesis for Ph.D. degree at the University of Chicago. August, 1924.)

The purpose of this study was to make a careful and detailed analysis of the present-day significance to Chicago of the lake waterway on which it is located. The materials used consisted of (1) statistics of lake and rail traffic at Chicago, both published and unpublished; published statistics of production, consumption, and shipment of commodities concerned in the regions served through Chicago; freight rates by lake and by rail; (2) published findings of previous surveys and historical information available in libraries; (3) detailed information obtained from personal conferences; (4) detailed information secured from personal observation throughout the port of Chicago.

The main conclusions: (1) Lake traffic constitutes an important though minor part of the total commerce at Chicago. (2) The chief advantage of lake transportation is the saving in costs of shipment which in most cases however is relatively small in amount. (3) The chief handicaps to the use of lake transportation are the incompleteness of the Great Lakes waterway which prevents the large lake vessels from reaching the eastern markets and seaports, the closing of the waterway because of ice for a third of the year, the ability of the railroads to receive and deliver freight at points scattered throughout the city, and intangible factors such as the prejudice of shippers and the interlocking interests of railroads. (4) Hindrances to navigation on the Chicago River are of only minor importance.

2. The Significance of Lake Transportation to the Grain Traffic of Chicago. *Economic Geology*. (In press.) Abstract published in *Science*.

This is a shorter paper based upon the foregoing thesis.

## GEOLOGY AND MINERALOGY

WILLIAM H. EMMONS, Ph.D., Professor and Head of the Department of Geology and Mineralogy; Director, Minnesota Geological Survey.

1. Primary Downward Changes in Ore Deposits. *Transactions of the American Institute of Mining Engineering*, 70:964-97. 1924.

Mineral veins are generally found in or near intruding igneous rocks. The metals were deposited by solutions expressed from the intrusive in the process of cooling. These intrusions as a rule have the shape of a short and broad based cone. If erosion has removed only the tip of the cone so that its exposure is less than five miles wide, the deposits are generally found in the intrusive and around it. If the cone is deeply truncated and more of it is exposed the ore lodes are found mainly in the rim of the intrusive and beyond the rim, and practically never in the center. If erosion is deeper still, ore deposits are generally wanting.

It is believed that the mineral-bearing solutions which originated in the igneous mass moved out from the very hot central part to and beyond the rim. The metals are found in series at varying distances from the intrusive center. The series passing outward from the igneous intrusive is: tin, tungsten, arsenic, bismuth, gold, copper, zinc, lead, silver, gold, antimony, mercury. The same series in reverse order is seen in part, passing from the surface downward in a single vein. It is believed that the metals were deposited in order of their solubilities, the least soluble being precipitated nearest the source.

2. Minnesota Geological Survey. In the President's Report for the year 1924-1925. *Bulletin of the University of Minnesota*.

The work of the Geological Survey is described in detail in the annual report of the director, which is included in the President's Report.

3. See also the studies by J. S. De Lury, P. J. Shenon, and H. A. Schmitt.

FRANK F. GROUT, Ph.D., Professor of Geology and Mineralogy.

1. The Relation of Texture and Composition of Clays. In press in the *Bulletin of the Geological Society of America*, 1925.

Twelve Minnesota clays of diverse origin and character, which had been analyzed, were separated mechanically into five fractions, from coarse sand to fine clay, and each fraction was analyzed.

Silica is at a maximum in the fine sand portion of most clays. Alumina, iron oxides and potash are at a minimum in this portion, but while they rise a little in the coarse sand, they reach their highest proportion in the fine clay portion. Other oxides show less regularity.

An estimate of the minerals is made on the basis of all available information, though it may never be possible to tell how much colloidal material is present, making the calculation inaccurate. It seems clear that kaolinite and limonite are larger in clays than in silts, while quartz and carbonates are smaller. Others are less regular.

A detailed comparison of "fluxing constituents" and the temperatures of viscous fusion, led to the suggestion that the behavior of a clay in firing is determined not so much by the total fluxes as by the proportion of fluxes in the fine clay fraction.

2. The Couthiching Problem. In press in the *Bulletin of the Geological Society of America*, 1925.

To decide whether maps of the rocks along the boundary show correct relations. All geologic methods were used. Several seasons field work, chemical and microscopic studies. The Couthiching formation, shown in most maps and reports since 1884, probably never occurs in the assumed position.

3. Notes on Biotite. *American Mineralogist*, 9:159-64. 1924.

To show the relation of the composition of the mineral to its physical properties. Samples were collected from about twenty rocks in the northern part of Minnesota, and some were already available in the museum. Several were analyzed. All were tested microscopically for optical characters. The indices of refraction of biotite are higher than indicated in the textbooks and compilations. There is a fairly uniform curve of increase in index of refraction with increase in iron content.

4. A Peculiar Shonkinite Related to Granite. *American Journal of Science*, 9:472 ff. 1925. (In press.)

This is a new species of rock, recorded for general information. Rock discovered in the course of Geological Survey work between the Mesabi Range and Canada; given careful study, microscopically and chemically and in the field. New species.

5. The Vermilion Batholith of Minnesota. *Journal of Geology*, 1925. (In press.)

Purpose is to place on record much old scattered data and an even larger accumulation of new data about the largest body of igneous rock in Minnesota. Material was collected over six seasons on the Minnesota Geological Survey and given detailed study during several winter seasons. The mass is probably typical of many in the "Canadian shield," and shows a somewhat new series of rock types.

6. A Magnetite Segregation in Banded Syenite in Minnesota. *Economic Geology*, 1925. (In press.)

Describes a new type of iron ore deposit in Minnesota. Material was collected north of Ely, Minnesota, by Geological Survey party in 1924. Tested in the Geological and Mines Experiment Station laboratories. This is different ore from any hitherto described, but is too small to promise important developments.

7. The Geology and Magnetite Deposits of Northern St. Louis County. *Bulletin of the Minnesota Geological Survey*. (In press.)

Intended to be a guide to prospectors and explorers for iron ore north of the Mesabi and Vermilion ranges. Based on about six seasons of field and laboratory work. Few iron deposits north of the known ranges have any prospective value. There are some minor deposits of other valuable minerals. The magnetites occur as erratic segregations in erratically distributed pegmatites. No deposit as large as ten acres has been found to show more than 5 per cent iron. Tests are reported in detail. About 100 pages of text and 100 maps.

8. Notes on Stilpnomelane. (See abstract under G. A. Thiel.)

9. (With H. J. Conhaim.) The Rate of Secondary Enrichment. *Economic Geology*, 20:289-91. 1925.

A note based on the thesis of H. J. Conhaim for the degree of E.M. in Geology.

10. (With G. M. Schwartz.) An Alunitic Gold Ore in the Black Hills, South Dakota.

To report a new type of deposit. Material collected on student field trips to Dakota. Now being studied in the laboratory, microscopically.

11. Petrographic Features of the Gold Prospects in Minnesota.

Description and classification as a guide to reasonable prospecting. Materials collected and microscopic rock sections prepared in connection with Geological Survey work several seasons. The only important ores and most promising prospects are tourmaline veins near some granite stocks. Paper in preparation.

12. See also the studies by I. S. Allison, W. A. P. Graham, H. R. Kamm, R. J. Leonard, F. J. Pettijohn, and H. A. Schmitt.

CLINTON R. STAUFFER, Ph.D., Professor of Geology.

1. The Fossil Elephants of Minnesota. *Science*, 60:41-42. 1924.

About thirty-five different skeletons of mastodons and mammoths have been found within the state. This article lists the more recent finds and describes, in some detail, the skeleton of *Elephas jeffersoni* found on the McMillan farm in 1923.

2. Mineralization of the Platteville-Decorah Contact Zone in the Twin City Region. *Bulletin of the Geological Society of America*. (In press.) Abstract in the *Pan-American Geologist* 43:158-59. 1925.

In addition to the field work, a number of chemical analyses were made and it is shown that the order of mineralization passes from solution, especially of the highly calcareous shells, through dolomitization and pyrite deposition to the final stage when the calcite geodes were formed.

3. The Jordan Sandstone. *Journal of Geology*. (In press.)

The Jordan sandstone is redefined on the basis of the original description and a study of the formation throughout Minnesota and adjacent states. Tentative identifications of its fauna are given and its relationship to other Cambrian formations is determined.



4. Minnesota's Oil and Gas Possibilities. *Bulletin of the American Association of Petroleum Geologists*. (In press.)

The gas found in the drift of Minnesota comes from the buried peat and forest beds. The older formations lack the hydrocarbons essential to oil and gas development; besides the sands that might act as reservoirs are filled with fresh artesian water. Minnesota must therefore be considered unfavorable for the occurrence of petroleum.

5. Ordovician Faunal Studies.

Under this head a complete study of the Middle and Upper Ordovician has been attempted. There is some doubt as to the application of the formational names now used for the divisions of this system. When the study is completed the formations will be redefined if necessary, and the new species described. Up to the present nearly three thousand species have been studied and of these about twenty appear to be new. Materials and sections from the whole southeastern part of the state are on hand and the study will continue through several years.

6. See also the studies by E. Peterson and F. J. Pettijohn.

JOHN W. GRUNER, Ph.D., Assistant Professor of Geology and Mineralogy.

1. Contributions to the Geology of the Mesabi Range. *Minnesota Geological Survey Bulletin* 19. 1924. 70 pages.

The origin and distribution of the iron-bearing formations and the origin of the Mesabi ores were investigated. It was concluded that the iron of the formation was derived from ancient land surfaces by weathering and precipitated in the area by organisms, especially iron bacteria.

2. Discovery of Life in the Archean. *Journal of Geology*, 33:151-52. 1925.

Fossil algae resembling living forms were found in the Archean Soudan formation of Minnesota. This proves the existence of life in the earliest sedimentary rocks known at the present time.

3. Oxidation of Magnetite to Martite.

The oxidation of magnetite was tried in hot solutions and in dry heat. The solution of this problem is of importance in connection with various geologic investigations. The work is in progress.

4. Hydrothermal Alteration of Ferromagnesian Minerals.

Minerals are heated in solution at boiling temperatures and above 100°. Any changes in the minerals are noted by X-rays. The problem is to find under what conditions such changes have taken place in ore deposition and other geologic processes. Work in progress.

5. See also abstract listed under F. A. Gray.

GEORGE M. SCHWARTZ, Ph.D., Assistant Professor of Geology.

1. A Guidebook to Minnesota Trunk Highway Number 1. *Minnesota Geological Survey, Bulletin* 20. 128 pages. 1925.

A guide to the features along the highway which extends from the south state line near Albert Lea to the Canadian boundary at the Pigeon River in the extreme northeastern part of the state. Includes maps of the entire region, sketch maps and photographs of some of the more important local features. Geology is emphasized but notes on the history of the region and chapters on plant life and game and fish, contributed by authorities, are included. The purpose of the bulletin is chiefly educational and it is arranged primarily for the convenience of the traveler.

2. Contact Effects of Gabbro and Granite on Ore Deposition. *Economic Geology*, 19:681-84. 1924.

It is well known that metallic deposits of epigenetic origin are more abundantly associated with the intermediate and acid rocks than with basic rocks. A comparison of the contact effects of gabbro and granite intrusions indicates that an abundance of water and other mineralizers are given off by granites, whereas there is evidence of actual dehydration at gabbro contacts. Inasmuch as ores are commonly believed to be deposited by solutions it is to be expected that deposits would be more abundant near granite intrusions.

3. On the Nature and Origin of Hisingerite from Parry Sound, Ontario. *American Mineralogist*, 9:141-44. 1924.

Hisingerite, a hydrous silicate of iron and magnesia, was found during a laboratory study as an abundant constituent in ore from a Parry Sound copper deposit. The material is unusual, as apparently both amorphous and crystalline hisingerite occur intimately associated. The minerals which have formed hisingerite by alteration have been but imperfectly known. In this case the hisingerite resulted from the alteration of hypersthene which had not previously been listed as a source of the mineral.

4. Xonotlite and Pectolite in a Diabase Pegmatite from Minnesota. *American Mineralogist*, 9:83-87. 1925.

An investigation of comparatively rare minerals found in a vein exposed by blasting on Highway No. 1, east of Two Harbors, Minnesota. The material was found while engaged in field work for the Minnesota Geological Survey. Although xonotlite ( $5\text{CaO} \cdot 5\text{SiO}_2 \cdot 2\text{H}_2\text{O}$ ) is a rare mineral, this is the second occurrence of considerable amounts found by the writer in connection with the diabase intrusives of the north shore of Lake Superior. Both occurrences are characterized by associated minerals indicating high temperature conditions of formation.

5. A Sulphide Diabase from Cook County, Minnesota. *Economic Geology*, 20:261-65. 1925.

A field and laboratory study of an unusual deposit of copper iron and nickel sulphides found in Cook County, Minnesota. The material was collected while on field work for the Minnesota Geological Survey. It was concluded that the sulphides in part represent original minerals of the igneous rock. The major part of the sulphides are found in a vein associated with the rare mineral xonotlite. This is the first discovery of a deposit of this type in Minnesota.

6. Geology of the Etta Spodumene Mine, Black Hills, South Dakota. *Economic Geology*. (In press.)

A complete description of the mine based on field and laboratory studies and including an accurate map and cross section of the pegmatite. The mine was examined as a part of the field work of the annual field trip (1924) of the Department of Geology to the Black Hills. This deposit is famous for the huge crystals of spodumene which it has produced. The largest recorded was forty-two feet long and from three to six feet in diameter and contained thirty-seven tons of spodumene. A complete analysis of spodumene from one of the large crystals was made by R. J. Leonard and the lithia content proved to be 6.78 per cent. An explanation accounting for the unusual deposit is given.

7. (With R. J. Leonard.) The Alteration of Spodumene of the Etta Mine, Black Hills, South Dakota.

In the Etta mine the spodumene may be observed in varying stages of alteration, but no study had previously been made of the nature of this alteration. During the annual field trip of the Department of Geology, seven specimens were selected

as representing a gradation from fresh to altered material. Analyses and microscopic study showed that the lithium content has almost disappeared in the more altered specimens and entirely new minerals developed, mainly a mica corresponding somewhat to muscovite.

## 8. The Nature and Significance of Intergrowths of Some Sulphide Minerals.

A microscopic study of many sulphides in the mineralography laboratory of the University and of similar material contributed by various workers in the field has shown that characteristic intergrowths are found in sulphide ores of the high temperature type. This is particularly conspicuous in the case of chalcopyrite ( $\text{CuFeS}_2$ ), cubanite ( $\text{CuFe}_2\text{S}_3$ ), and pyrrhotite ( $\text{Fe}_4\text{S}_5$ ), and thus far the investigation has been mainly confined to a study of these minerals. From theoretical considerations it was assumed that the material from which the minerals crystallized was a mutual solution. The texture developed either as a simultaneous crystallization of two minerals or by the unmixing of a solid solution at a later time. If the latter were true it should be possible to cause the minerals to revert to a solid solution by proper heat treatment. Preliminary tests on specimens containing chalcopyrite-cubanite intergrowths prove that a mutual solution may be had at a temperature around  $500^\circ \text{C}$ . Further experiments will be necessary to determine the exact facts regarding the reversions. These results will have an important bearing on many concepts of the conditions and processes of formation of many ores, particularly those of the high temperature type.

## 9. See also the study listed under F. F. Grout.

GEORGE A. THIEL, Ph.D., Assistant Professor of Geology and Mineralogy.

### 1. Iron Sulphides in Magnetic Belts Near the Cuyuna Range. *Economic Geology*, 19:466-73. 1924.

The portion of the Cuyuna Range south of the Northern Pacific Railroad from Brainerd to Aitkin contains numerous lenses of magnetite slates. Locally, sufficient magnetite is present to produce strong magnetic deflections, and for this reason numerous magnetic lines have been mapped that have served as guides for exploratory drilling for iron ore. A study of the rock formations in the region southeast of Long Lake showed, however, that the magnetic attraction of that region is due to magnetic iron sulphides and not to concentrated ore. Therefore, the details of the petrographic features of the slates were studied for the benefit of the prospector and to check needless expenditure of funds for drilling in the magnetic belts high in sulphides. Diamond drill cores were used as a basis for correlation of strata and for a study of the paragenesis of the sulphides.

### 2. High Temperature Manganese Veins of the Cuyuna Range. *Economic Geology*, 19:377-81. 1924.

The Cuyuna Range in Minnesota contains the largest reserve of manganese in the United States. It is mostly in the form of a manganiferous iron ore. The origin of the manganese has been quite generally referred to manganese-bearing sedimentary rocks in the Deerwood formation. A study of the veins cutting that formation shows, however, that at least a part of the manganese was introduced into the sediments after the major deformation and metamorphism had been completed. The manganese in the veins is mostly in carbonate form, associated with such characteristic high temperature vein minerals as pyroxene, specularite, apatite, adularia, epidote, and microcline.

### 3. Study of Polished Surfaces. *Economic Geology*, 19:582-85. 1924.

The determination of anisotropism in polished minerals through the use of reflected polarized light was discussed with special reference to the optical effects produced. Polished surfaces of metallic and non-metallic minerals were studied. It was

concluded that the Wright biquartz-wedge-plate used as recommended by Dr. Simpson is of value for polished surfaces of ores in which there are transparent colored minerals and fine aggregates of opaque minerals that show but slight anisotropism between crossed nicols.

4. Commercial Possibilities of the Magnetite Slates of the Cuyuna Range. *Engineering and Mining Journal-Press*, 118:735-38. 1924.

Outlines briefly the occurrence of magnetite-bearing formations, their relation to the intrusive igneous rocks of the region, and the bearing of the microstructure of the ore on the possibility of magnetic concentration. It was concluded that the distribution of magnetite is not uniform over any large area, and that the texture of the ore would make fine grinding imperative before the silica grains could be liberated and removed.

5. (With F. F. Grout.) Notes on Stilpnomelane. *American Mineralogist*, 9:228-31. 1924.

The occurrence of stilpnomelane in the Animikian iron formations was reported. Its optical and chemical properties were determined. It was found to be intermediate between chlorites and biotites.

6. Manganese Precipitated by Micro-Organisms. *Economic Geology*, 20:301-12. 1925.

An abstract of the results of a series of experiments dealing with the precipitation of manganese from meteoric and marine waters through the activity of living fungi and bacteria, with special reference to the origin of sedimentary manganese ores. Manganese-precipitating organisms were isolated from fresh peat, various types of soils, marine muds, and mine waters.

7. Origin of the Phosphorus in the Non-Bessemer Ores of the Cuyuna Range.

A chemical and petrographic study of the ores and protores in an attempt to explain the erratic distribution of  $P_2O_5$  in parts of the Deerwood iron formation. Work in progress.

8. Magnetite-Stilpnomelane Rocks of Minnesota.

A study of the crystalline schists associated with the iron formations, with special reference to stilpnomelane as an index to the degree of metamorphism. Work in progress.

9. Contributions to the Geology of Sedimentary Manganese Ores. To be published as a *Bulletin of the Minnesota Geological Survey*.

A study of the fresh water and marine deposits, together with experimental work to determine the form in which manganese is carried in solution and precipitated in manganiferous sediments. The morphology and physiology of micro-organisms involved.

IRA S. ALLISON, Ph.D., Instructor in Geology and Mineralogy.

1. The Giants Range Batholith of Minnesota. *Journal of Geology*, 1925. (In press.) (Thesis for the Ph.D. degree; F. F. Grout, Adviser.)

A field and laboratory study of the structure, petrography, and petrology of the Giants Range granite and associated rocks. The Giants Range batholith is a great body of granite in northeastern Minnesota that lies between the Mesabi and Vermilion iron-bearing districts. It outcrops as a narrow belt that strikes east-northeast and occupies an area of about 1,000 square miles. The granite intrudes Archean and Lower-Middle Huronian rocks and is overlain unconformably by Upper Huronian sediments. In general the top of the batholith seems to have been flat except for a row



of cupolas which now form the Giants Range. The lateral contacts strike nearly parallel to the adjacent schists. Intrusive effects along the borders include marginal breccias, roof pendants, *lit-par-lit* injection, and contact metamorphism. Like most large intrusions the batholith shows much internal complexity. Hornblende and biotite granites, low in quartz and rich in soda, predominate but variations in mineral composition and texture are numerous. Differentiation produced rocks ranging from diabase and shonkinite to soda-granite. Assimilation of wall rocks probably was slight. Examples are given illustrating the reactive principle described by Bowen. Ore deposits derived from the granite magma are unknown.

## 2. A Contribution to the Study of Enrichment of the Iron Ores of the Mesabi Range of Minnesota. *Economic Geology*. 1925. (In press.)

A discussion of the field and chemical relations of the ore bodies, as shown by maps and published results of chemical experiments. Other workers have shown that solutions of alkalis and of alkaline earth bicarbonates are effective solvents of silica and therefore capable of leaching silica from protores of iron, and that solutions of magnesium bicarbonate especially are effective in removing silica in the presence of both silica and iron. The Giants Range granite is rich in alkalis and the Ely greenstone is rich in magnesia. Therefore it is suggested that a test of the relative effectiveness of solutions of the alkalis as compared with solutions of magnesium bicarbonate be made by means of the relations of the ore bodies to the outcrops of granite and greenstone respectively. The test reveals that a larger part of the ore is derived from mines situated near outcrops of greenstone than from those near granite. Hence it appears that magnesian solutions derived from the weathering of the greenstone contributed more toward the enrichment of the iron ores than did alkaline solutions which may have come from the granite.

## 3. Double Metamorphism of Weathered Granite.

A petrographic description of a peculiar quartz-chlorite-amphibole-garnet rock occurring beneath the Biwabik iron formation on the Mesabi Range. The rock is a part of the Giants Range granite which was weathered, impregnated with iron solutions, buried, and later recrystallized as a result of both regional and contact metamorphic processes.

## 4. Sub-Surface Geology and Water Supply of Northwestern Minnesota. (In progress.)

Collection and organization of data furnished largely by well-drilling, especially concerning the bedrock, the location of artesian areas, the quality of the water from various sources, the saline waters of part of the Red River Valley, etc.

F. ANTON GRAY, B.S., Assistant in Chemistry.

(With R. B. Ellestad.) A Study of the Crystallography of the Double Nitrates of Praseodymium and Neodymium with Certain Bi-valent Elements. (Work under the direction of J. W. Gruner.)

FRANCIS J. PETTIJOHN, M.A., Assistant in Geology.

A Study of the Black Phosphatic Pebbles in Ordovician Limestones near Minneapolis. (Thesis for M.A. degree; under the direction of F. F. Grout and C. R. Stauffer.)

To determine the conditions under which phosphate deposits are found. Material collected in quarries and outcrops near the Twin Cities and in Wisconsin; studied microscopically and chemically. Shows the marine nature of the reaction.

JUSTIN S. DELURY, Ph.D., Graduate Student.

Study of the Geology and Mineral Deposits of Wapawekka and Deschambault Lakes, Saskatchewan. (Thesis for the Ph.D. degree; W. H. Emmons, Adviser.)

The investigation included mapping of a large and little known area of the pre-Cambrian shield.

WILLIAM A. P. GRAHAM, M.S., Graduate Student.

The Composition and Properties of Hornblende. (F. F. Grout, Adviser.)

Purpose is to aid students of rocks to estimate the composition of brown hornblende in various rocks. Used the specimens in the department and tested them under heat treatment and by microscopic studies in oils. Seems to have proved (1) that brown hornblende is usually formed by dehydrating green hornblende; (2) no estimates of the nature of hornblende can be based on occurrence alone.

HUGO R. KAMB, Undergraduate Student.

Measurement of the Plasticity of Clay. (Thesis for degree of E.M. in Geology; F. F. Grout, Adviser.)

Purpose, to devise a simple apparatus for rapid estimates of the plasticity of a wet clay. Geological Survey samples of clay are available. Several types of apparatus were invented and given trial. Some worked so well as to interest clay workers in Minneapolis and St. Paul.

R. J. LEONARD, Undergraduate Student.

The Optical and Chemical Properties of Alkali Feldspars. (Under the direction of F. F. Grout.)

Intended to give a method of accurately estimating the nature of our most abundant rock minerals. Made up and tried out a set of refractive oils in which to test minerals. Work in progress.

EUNICE PETERSON, B.A., Graduate Student.

The Dresbach Formation of Minnesota. (Thesis for the Ph.D. degree; C. R. Stauffer, Adviser.)

The Dresbach is the lowest outcropping Cambrian formation in Minnesota and neither its stratigraphy nor its fauna have been properly studied. Some field work has been done, but much more is contemplated and a study of the fauna is under way. Part of this fauna is new and most of it has been confused with the Eau Claire of Wisconsin. This study is bringing out the distinctness of the Dresbach fauna and will probably establish definitely the relationship of the formation in the geological column.

HARRISON A. SCHMITT, M.S., Graduate Student.

The Geology and Rocks of Some Mexican Mines. (Under the direction of W. H. Emmons, F. F. Grout, and G. M. Schwartz.)

A guide to future prospecting at depth. Material collected by Mr. Schmitt in two years' work in Mexico. Now being continued.

PHILIP J. SHENON, M.S., Graduate Student.

Study of the Geology and Mineral Deposits of the Region near Banrock, Montana. (Thesis for the Ph.D. degree; W. H. Emmons, Adviser.)

The investigations include the mapping of the geology of a complicated area in southwestern Montana, lying in the area east of the main Idaho batholith. Work in progress.

WALTER S. YARWOOD, M.S., Research Assistant.

### The Alteration of the Knife Lake Slate Formation.

Purpose to aid in mapping the geology of Minnesota and to promote a general understanding of rock alteration. Material collected by the Minnesota Geological Survey. Analyzed chemically and microscopically. Alteration changes the chemical composition much more than was supposed. More work needed. The results furnish a basis for several fundamental geologic theories of rock alteration. To be published later.

## GERMAN

CARL SCHLENKER, B.A., Professor of German and Chairman of the Department of German.

### 1. Studies in Modern German Drama.

A revaluation of German dramas since 1880. Dramatic theory and practice; problems, characterization, and motivation. Special attention is paid to social-pathological trend. Foreign influences.

2. See also the studies by M. Huhn, G. Wangsness, E. Heminghaus, and K. Tschida.

SAMUEL KROESCH, Ph.D., Associate Professor of German.

### 1. French "*Flanc*." To be published in *Modern Philology*.

A new etymological connection for this word, deriving it from the Germanic *flank*—"move to and fro." Semantically the word represents "that portion of the body which moves to and fro in breathing."

### 2. Analogy As a Factor in Semantics.

Work in progress.

JAMES DAVIES, Ph.D., Assistant Professor of German.

### Music to Goethe's *Faust*.

The original purpose was to prove who wrote the first musical setting to *Faust*. It is shown conclusively that this honor belongs to Prince Radziwill. The basis of the material is Zelter's correspondence with Goethe, leading to comparison of contemporary musical adaptations of the *Faust* theme with the Radziwill setting and showing the extent and direction of contemporary opinion on the work. The work is being continued to indicate to what extent *Faust* has been the inspirational source for many other composers as shown in operas, overtures, symphonic poems, and symphonies.

GEORGE F. LUSSKY, Ph.D., Assistant Professor of German.

1. *Werdan und Wesan mit dem Partizip Passiv in der althochdeutschen Tatianuebersetzung*. *Journal of English and Germanic Philology*, 23:342-69. 1924.

In this article the Old-High German text was compared with the Latin text with the purpose of ascertaining the use, the meaning, the origin, the temporal value, and the syntactical use of the passive circumscriptions with *Werdan* and *Wesan* in Old-High German. The results of this investigation show that *Werdan* and *Wesan* are not used indiscriminately, as would seem to be the case at first glance. *Werdan*, unlike *Wesan*, never denotes a condition or fact already existing, but always the beginning of a condition or fact. The origin of these circumscriptions is to be sought in the aspect of the verbs. The temporal value of these circumscriptions is originally present and preterit; however, some of them have already clearly developed the force of our

modern perfect and pluperfect tenses. The syntactical use of these circumscriptions is not influenced by the Latin alone, but must be explained in part from the Old-High German. The situation seems to be that the Old-High German translator tried to render Latin tense forms, for which the Old-High German had no equivalents, by the aspects of the verb, which in many cases very closely resemble the Latin tenses in meaning.

2. See also the study by Jacob Cornils.

GINA WANGSNES, B.A., Instructor in German.

Schiller's Philosophic Studies and Their Effect upon His Plays. (Thesis for the M.A. degree; C. Schlenker, Adviser.)

JACOB CORNILS, B.A., Graduate Student. (Professor of German at Phalen Luther College.)

Luthers Stellung zu den leitenden Fragen seiner Zeit bis zum Jahre 1524. (Thesis for M.A. degree; G. F. Lussky, Adviser.)

The work has not progressed far enough as yet to warrant any statement as to method or results.

EDGAR HEMINGHAUS, M.A., Graduate Student.

Schiller's Use of Contrast in His Dramas. (Thesis for the M.A. degree; C. Schlenker, Adviser.)

A study of a phase of Schiller's dramatic technique.

MIRIAM HUHNS, B.S., Graduate Student.

Heinrich von Kleist's Ideas of Woman. (Thesis for the M.A. degree; C. Schlenker, Adviser.)

An attempt to arrive at a synthetic conception of Kleist's viewpoint of sex, and the effect thereof upon his life and death.

KATHERINE TSCHIDA, B.A., Graduate Student.

Pathological Problems in the Dramas of Gerhard Hauptmann. (Thesis for the M.A. degree; C. Schlenker, Adviser.)

A study of Hauptmann's plays to determine the correctness of his pathologically diseased and subnormal beings; together with a study of his sources and authorities.

## GREEK

DOROTHY STRONG, B.A., Assistant in Greek.

The Functions of the Greek Chorus with Their Survival in Modern Drama. (Thesis for the M.A. degree; C. A. Savage, Adviser.)

The purpose is to show that the functions of the chorus did not disappear with the disappearance of the chorus. The material is derived from ancient and modern dramas.

## HISTORY

OLON J. BUCK, Ph.D., Professor of History.

1. (With Wayne E. Stevens.) The British Régime in the Upper Northwest.

The purpose of this work is the assembling of all important documents bearing on the history of Minnesota and the surrounding country from 1760 to 1815 for



publication in a series of volumes by the Minnesota Historical Society. Much important material hitherto unknown to students has been collected from London, Montreal, Ottawa, Toronto, Washington, and other places. The documents are to be annotated and the volumes will contain interpretative introductions.

2. (With Bryce E. Lehman.) Minnesota Newspapers, 1849-1900.

This is to be a bibliography of all newspapers published in Minnesota in the nineteenth century, with information about editors, publishers, characters, etc., together with an inventory of all files that can be located. The data are collected from newspaper directories, gazetteers, local histories, and files of the papers, especially the collection of the Minnesota Historical Society. Considerable field work has been done in order to collect data from newspaper offices and other local sources of information. The assembling of data is nearly finished and the work of putting it in shape for publication has begun.

3. See also the studies by T. C. Blegen, E. B. Gustafson, E. A. Moore, and W. Williams.

WILLIAM W. FOLWELL, LL.D., President Emeritus.

A History of Minnesota, Volume 3.

This volume covers the period from 1865 to date and is to be followed by a fourth volume dealing with special phases of the state's history. Volumes 1 and 2 were published in 1921 and 1924 respectively. All available material is being used and especially the newspaper and manuscript collections of the Minnesota Historical Society. The manuscript of Volume 3 has been completed and is being prepared for the press under the editorial direction of Solon J. Buck.

NORMAN S. B. GRAS, Ph.D., Professor of Economic History.

1. A History of Agriculture in Europe and America. Textbook. New York: F. S. Crofts and Co. May, 1925.

A study of the evolution of agricultural methods from the time that cultivation of the soil began, with attention to the underlying factors accounting for change. Both manuscript and printed materials used.

2. Anthropology and Economics. An article in the volume on the *Interrelations of the Social Sciences*. New York, 1925.

3. History of an English Village (1208-1925).

A study of the agricultural technique, field system, tenancy, and courts of a typical village. In progress.

4. See also the studies by M. Hartsough, C. B. Kuhlmann, and H. P. Mudgett.

AUGUST C. KREY, Ph.D., Professor of History.

1. (With Mrs. W. M. Babcock.) Critical Translation: William of Tyre, *Historia rerum in partibus transmarinis gestarum*.

The masterly chronicle of the crusades written by the scholarly Archbishop of Tyre has not been translated into English except in fragments. The task involves some serious critical problems. The question of sources which William drew upon for his earlier material has some difficulties. More serious problems are presented by chronological complications in the middle of the work and the fate of the original work which was early submerged under a host of continuations by various authors is also considered. Chief emphasis, however, is placed upon the translation.

2. See also the studies of G. F. T. Mayer, G. C. Hansler, F. R. Ryan, and R. M. Malone (College of Education, Department of Educational Administration).

LESTER B. SHIPPEE, Ph.D., Professor of History.

1. Recent American History. New York: The Macmillan Company. 1924. 554 pages.

This is a study of the history of the United States after the Civil War with particular emphasis on the period following 1877. An attempt is made to show the interworking of economic with political forces, and to bring out something of the trend of national development in a period of changing standards, economic, social, and political. While primarily intended for use as a text for college classes, it is also calculated to be of some general interest to those who are concerned in the events of the past years bearing upon and affecting present conditions. The sources include a considerable array of official publications, reports and findings of committees of various kinds, numerous monographs, general histories, biographical studies, and the like.

2. Studies in the Foreign Relations of the United States, 1865-.

The purpose of the studies is to re-examine some of the more important topics of American foreign relations in the past half century or so in the light of new material which has been brought to light in the last few years. Such publications as *Die Grosse Politik der Europäischen Kabinette*, issued under government auspices in Germany, have thrown much light on various factors which concerned America. The Foreign Office in England and the Department of State in Washington have shown a disposition to be much more liberal in allowing the use of the unpublished archives, and these facts make it possible to re-estimate many problems. One result of these investigations has been a paper, entitled "Germany and the Spanish-American War" which is being published in the July, 1925, issue of the *American Historical Review*.

3. See also the studies by H. Egan, M. L. Norem, and A. F. Tyler.

ALBERT B. WHITE, Ph.D., Professor of History.

A Study in the Beginnings of English Self-Government.

This study advances the thesis that medieval English kings made an exceptional use of the common people in government, especially local government, and that though some of this has long been known in connection with various institutional studies yet it has not been studied for its own sake and in the mass, and that its mass significance is great. This service was unpaid and looked on as a normal function in the life of the citizen, its continuance for centuries may have gone far towards creating the Englishman's governmental sense and competence, and through England may add to knowledge of the beginnings of self-government in general. A beginning in support of this thesis is made by a detailed study of the people's share in government in the first quarter of the thirteenth century. The material used has been largely the Chancery enrolments, the plea rolls, and Bracton's treatise. These yield a mass of data about the people's work both inside and outside the courts of law; and in both cases these uses of local men vary infinitely from the most mechanical services of witnessing and memory to elaborate estimates, judgments, or difficult charges in which responsibility (and often risk) was large.

In conclusion notice is taken of the amateur character and slight compensation of many of the so-called officials of the time, and of the persistent efforts of the people to buy themselves free from long lists of governmental jobs. This study is still in progress and should be continued to the time when self-government was becoming an ideal with the English people.

See also the studies by F. Thompson, H. N. Hendrickson, G. Jacobson, and L. O'Malley.

MASON W. TYLER, Ph.D., At one time Associate Professor of History.

The European Powers and the Near East, 1875-1908. *Research Publications of the University of Minnesota, Social Science Series*, Number 17, 1925. 232 pages.

At the time of his death Professor Tyler was engaged in writing a diplomatic history of the Near East. It was his intention that the book should cover the period from 1875 to 1918 and he had completed the chapters bringing it down to about 1903. He left a great mass of notes representing an exhaustive study of the crisis of 1908 in such shape as to indicate fairly well what his treatment of that incident would have been. Due to the interest and kindness of Dean Guy Stanton Ford and of Professor William Stearns Davis a concluding chapter and part of another have been written making it possible to publish the book as a monograph for the period 1875-1908.

LAWRENCE D. STEEFEL, Ph.D., Assistant Professor of History.

#### 1. The Schleswig-Holstein Question.

Monograph expansion of thesis presented in partial fulfilment of the requirements for the degree of doctor of philosophy at Harvard University, June, 1923.

A study of the Schleswig-Holstein question with special attention to the policies of the great powers and to the diplomacy of the German-Danish War of 1864. The work is based on available published materials and on documents in the archives of London, Copenhagen, Berlin, and Vienna, and on copies of documents obtained through the kindness of a former French diplomat in Paris.

#### 2. See also the studies by M. L. McKinnie, and R. A. Norem.

MILDRED HARTSOUGH, Ph.D., Instructor in Economic History.

The Development of the Twin Cities—Minneapolis and St. Paul—As a Metropolitan Center. *Research Publications of the University of Minnesota, Social Science Series*, Number 18. 1925. (Thesis for the Ph.D. degree; N. S. B. Gras, Adviser.)

A survey of the development of the Twin Cities as a marketing center, and as the nucleus of the economic life of the Northwest. Attention is devoted to the factors making for concentration in the Twin Cities, to the development of the various branches of trade and industry, and to the history of transportation and financial growth. A sketch is furnished also of the development of the Northwest outside the Twin Cities. This monograph was prepared not only as a study in local history, but also as illustrating a development typical of modern economic life, the rise of marketing centers through which the producers and consumers of the surrounding areas carry out their interrelationships, and which act as the nucleus of most phases of economic life for those areas.

FAITH THOMPSON, Ph.D., Instructor in History.

The First Century of Magna Carta: Why It Persisted As a Document. *Research Publications of the University of Minnesota, Studies in the Social Science Series*, Number 16. 1925. 116 pages. (Thesis for the Ph.D. degree; A. B. White, Adviser.)

The story of Magna Carta, 1215-1307, in the nature of an exposition of all the factors which helped to establish it, to explain why it persisted as a document, the early foundation for its long career of endurance and fame. Examination of the

extensive printed sources available for this period (chronicles, close and patent rolls, plea rolls, etc.), makes it possible to show in conclusive detail that most of the specific provisions of the charter did not become obsolete in this period, but remained of vital interest to the various classes concerned. The unusual combination of so many kinds of "liberties" in one document drew all the articulate classes of the day to its support, and revived at times of crisis the "national" combination of 1215.

DAVID H. WILLSON, Ph.D., Instructor in History.

1. The Diary of Robert Bowyer, 1605-7.

This is the editing of a manuscript to be found in the Harleian Collection in the British Museum. The manuscript was written by Robert Bowyer in the form of a diary during the years 1605-7 when he was a member of the House of Commons and contains the happenings in Parliament day by day for much of those years. It is of importance because no other parliamentary diary for those years has ever come to light and because it contains much evidence not to be found elsewhere. It is being edited from the printed material for the period and also from manuscript material in the British Museum and in the Public Record Office.

2. The Relation of the Privy Council and Parliament during the Early Stuart Period.

The problem involved in this work is to show how the Privy Council in the early Stuart period gradually lost the control over the actions of Parliament which it had enjoyed under the Tudor monarchs. During the reign of Elizabeth there had always been members of the Privy Council in the House of Commons and they had directed the actions of the House to a very considerable degree. But during the reigns of James I and Charles I, this power was lost and the House of Commons refused to be controlled by members of the Privy Council who of course represented the power of the crown. The material used consists of the printed records of Parliament at the time as well as unprinted diaries and letters to be found in the British Museum and the Public Record Office.

GEORGE F. T. MAYER, B.A., Teaching Fellow in History.

Raymond II of Tripoli and Renaud of Sidon. (Thesis for the M.A. degree; A. C. Krey, Adviser.)

This is the study of the career of two native nobles charged with treachery at the Battle of Hattin, 1187. It involves the study of the political conditions in the Latin East just before and during the period of the Third Crusade. The treachery of these two native nobles is made a matter of interpretation and is largely dispelled.

HELEN P. MUDGETT, M.A., Assistant in History.

The Economic Background of the Reign of James I. (Thesis in progress for Ph.D. degree; N. S. B. Gras, Adviser.)

Based on manuscript sources in English archives.

ALICE F. TYLER, M.A., Assistant in History.

The Foreign Policy of James G. Blaine. (Thesis for the Ph.D. degree; L. B. Shippee, Adviser.)

This study is intended to give an account of the activities, aims, and accomplishments of James G. Blaine in his capacity both as secretary of state under two presidents and as an individual not in public office. Among the more striking features of his activities in foreign affairs are his interest in, and his work to promote, stronger and more cordial relations between the United States and the countries of Latin America. This involves a consideration of his attitude toward the relations between the United States and Europe and their reactions upon the things which especially



concerned the western hemisphere. In addition to the printed official documents, biographical works of various kinds, and monographic studies of special phases, the material is to be found in the archives of Washington, particularly in those of the Department of State. The official publications of foreign countries afford much evidence bearing upon the subject.

THEODORE C. BLEGEN, Ph.D., Graduate Student. Professor of History in Hamline University and Assistant Superintendent of the Minnesota Historical Society.

Norwegian Immigration before the Civil War. (Thesis for the Ph.D. degree; S. J. Buck, Adviser.)

This is a study of the Norwegian immigration to the United States from the early twenties to the period of the Civil War, with special attention to the European backgrounds of the movement. The period is one in which the broad foundations of the modern Norwegian immigration were laid: the movement spread to all parts of Norway, a fundamental advertising movement occurred, and lines of settlement expansion in the United States were worked out. All these large factors are brought together and studied in their broad setting. The work is based upon manuscripts, official documents, books, pamphlets, and newspapers. Especially important are the books and pamphlets published in Norway from 1837 to 1865 which relate to the emigration. Many of these rare works have been copied from originals in Norway and are available for study in the library of the Minnesota Historical Society.

CHARLES B. KUHLMANN, Ph.D., Graduate Student. Professor of Economics, Hamline University.

The Development of Flour-Milling in the United States, with Special Reference to the Industry in Minneapolis. (Thesis for Ph.D. degree; N. S. B. Gras, Adviser.)

This was published as second-prize essay (Hart, Schaffner, and Marx). Based on manuscript and printed sources. Treats of the origin and growth of flour milling, technique, concentration, marketing, etc.

HOWARD EGAN, B.A., Graduate Student.

Irish Immigration to Minnesota, 1860 to 1890. (Thesis to be offered for the M.A. degree; L. B. Shippee, Adviser.)

This study is primarily to give an account of the organized colonization movement promoted by churchmen and laymen which resulted in the establishment of certain definite settlements of Irish in Minnesota, communities which were made up of Irish from other parts of the United States as well as from Ireland. Besides official documents, including federal and state census returns, reports of the Immigration Commission, etc., state and local histories, histories of Ireland and Great Britain, much material has been found in original letters, reports, and other documents relating to the movement now owned by the St. Paul Seminary. Corroborative material is found in newspapers.

ERNEST B. GUSTAFSON, B.A., Graduate Student.

British Occupation and Administration of the Great Lakes Region, 1760-63. (Under the direction of S. J. Buck.)

This work started as a seminar assignment but developed into an intensive study of the subject. It treats of the occupation of the frontier posts following the capitulation of Montreal, the regulation of the fur trade, the activities of the military and Indian departments, and the influence of the region on the development of the British western policy as embodied in the Proclamation of 1763. All available material has

been consulted. The results of the study have been written up and will be presented as a Master's thesis if the author decides to become a candidate for the Master's degree.

GEORGE C. HANSLER, M.A., Graduate Student.

The Theories of Pierre Debois As Expressed in His Writings Especially in *Recuperation Terra Sancta*. (Thesis for the M.A. degree; A. C. Krey, Adviser.)

This is primarily a careful analysis of the chief work of Pierre Debois of which a complete digest is appended. In addition the ideas of Pierre Debois are compared with those of his immediate predecessors, contemporaries, and successors, who wrote on political theory.

HENRY N. HENDRICKSON, B.A., Graduate Student.

The Use and Meaning of *Curia Regis* from 1066 to 1200. (Thesis for the M.A. degree; A. B. White, Adviser.)

The object of this piece of research is to determine whether *curia regis* denotes essentially a legal institution (or institutions) with clearly defined powers and specific functions, or whether it is a term loosely used to denote the typical court of a feudal king in its various activities. The term has been a famous one for centuries among historians of the English government, and misuses of it have undoubtedly distorted our notions of the development of central institutions. It is hoped that a measurably exhaustive study of the contexts in which the expression occurs will lead to a clearer understanding. Here is an instance in which it seems that constitutional history should be rectified by a detailed piece of linguistic research. This involves the careful examination of all Latin sources (both chronicles and official documents) that belong to the specified period. Work in progress.

GERTRUDE JACOBSON, M.A., Graduate Student.

The Relations between William III and William Blathwayt. (Thesis to be offered for the Ph.D. degree; under the direction of A. B. White.)

This is an investigation of the office of secretary of state in England during the reign of William III. This office had first become of importance in the reigns of Elizabeth and James I. The period studied here represents a temporary decline in the importance of the office, due to the desire of William III to have power in his own hands. It was his desire to make the secretary of state as much a mere clerk as possible. The subject is approached by the study of the career of William Blathwayt who was secretary of war to William but was given more power than such an appointment usually carried so that his position was actually that of secretary of state in a much modified form and with greatly curtailed powers. The material used consists chiefly of the printed correspondence of the principal members of the government. Some manuscript material in the British Museum has been used.

MARY L. MCKINNIE, B.S., Graduate Student.

Great Britain and the Secret Treaty of January 3, 1815. (Thesis for the M.A. degree; under direction of C. K. Webster and L. D. Steefel.)

A study of British policy in relation to the secret treaty of January 3, 1815, between Great Britain, Austria, and France, with special attention to the attitude of the British cabinet and public toward that policy.

EDMUND A. MOORE, B.A., Graduate Student.

The Political Career of Ignatius Donnelly, 1863-75. (Thesis for the M.A. degree; S. J. Buck, Adviser.)

This study is a continuation of one made by another student a number of years ago on Donnelly's earlier career. It covers Donnelly's career in Congress and the

first years of his leadership of radical forces in politics. The central problem is the explanation of the forces, both general and personal, which led to Donnelly's emergence as an independent in politics. The materials used are the *Donnelly Papers*, newspaper files, and other collections of the Minnesota Historical Society.

MARGARET L. NOREM, B.A., Graduate Student.

The Growth of the Demand in the United States for National Legislation on Child Labor. (Thesis for the M.A. degree; L. B. Shippee, Adviser.)

Early in the last century there was only an occasional protest about the work of children. Later the protest was more vigorous and resulted in state laws, while for the past thirty years the leaders have been working not for state but for federal legislation. What caused the shift in attention? How has the movement grown from about 1890 up to the present when an amendment to the Constitution is before the states for ratification? The material for this study is found principally in the *Congressional Record*, the *Annals of the American Academy of Social and Political Science*, the reports of the children's bureau in the Department of Labor, the *Bulletins of the National Child Labor Committee*, and a large number of short accounts found for the most part in works on economics which show the increase in volume of the interest on the subject.

RALPH A. NOREM, B.A., Graduate Student.

The Genesis of the Old Catholic Movement in Germany. (Thesis for the M.A. degree; L. D. Steefel, Adviser.)

The problem is to show how it came about, from the events which immediately followed the Vatican Council, that the Old Catholic movement arose in Germany. The chief source is Schulte, *Altkatholicismus*, a collection of letters written by the leaders in the movement against infallibility. The files of the *Allgemeine Zeitung of Augsburg* were also very valuable. Wherever Dollinger came in, Friedrich, *Dollinger*, (3 volumes) is indispensable. Friedrich, *Vatikanische Konzil*, and Friederich, *Tagebuch Während des Vatikanischen Concils*, are valuable for the background in the council itself. Purcell, *Manning*, (2 volumes) is important for showing the influence of Manning in bringing about the declaration of infallibility.

LORETTA O'MALLEY, M.A., Graduate Student.

The People's Share in the Government of the English Civil Parish in the Reigns of Elizabeth and James I, 1558-1625. (Thesis for the M.A. degree; A. B. White, Adviser.)

The object of this paper is to inquire into the type of governmental training which could be obtained in the civil parish, composed to a great extent of the yeoman class, which was to play an important part in the Puritan Revolution and American colonization. The source material used included: the *Statutes*, *Privy Council Records*, *Calendar of State Papers*; documents found in Prothero's *Select Documents*, Cardwell's *Documentary Annals*, Strype's *Life and Acts of John Whitgift*, and *Life and Acts of Edmund Grindal*, D'Ewe's *Journals of Parliaments of Elizabeth*, Harrison's *Description of England*, and material of a different nature, that is, financial records in churchwardens' accounts.

A considerable degree of autonomy was permitted in the parish, whose chief officers were unpaid, and were sometimes subject to a fine for refusing office. The legislative function was exercised by the parishioners in group meetings, known often as vestries. A vestry could levy taxes, elect officers, and make important administrative decisions of a political, social, economic, or in some instances, a judicial nature. There is also ample proof that the civil parish was not isolated from contact with higher units of government.

SISTER FRANCES R. RYAN, M.A., Graduate Student.

The Founding of the Latin Kingdom of Jerusalem. (To be offered as a thesis for the Ph.D. degree; A. C. Krey, Adviser.)

The study involves the history of the First Crusade and the establishment of the Latin kingdom of Jerusalem from 1099 to 1127. It is based upon the printed sources and includes a study of the writings on the crusades by western, Greek, and Oriental authors. It includes also the search of local western chronicles. The chief problem involved is that of building up on strange soil institutions drawn from various parts of Western Europe which had hitherto been developed separately. It involves also a problem in the organization of the Latin Church, the relationship of the Latin patriarchate in the East to the papacy at Rome.

WINWORTH WILLIAMS, M.A., Graduate Student.

Jonathan Carver and His Journals. (Under the direction of S. J. Buck.)

A critical study of the career of Carver and especially of his journals of his western travels as embodied in his published *Travels* and in two earlier manuscript versions which differ greatly from the printed one. Photostatic copies of the manuscript journals, from the original in the British Museum, are being used, also transcripts or photostats of other material from the Public Record Office in London and elsewhere. It is expected that this work will lead ultimately to a new edition of Carver's travels.

## MATHEMATICS

WILLIAM H. BUSSEY, Ph.D., Professor of Mathematics, Assistant Dean for the Junior College in the College of Science, Literature, and the Arts, and Chairman of the Department of Mathematics.

College Grades, Honor Points, and Scholastic Requirements.

Many colleges express their graduation requirements and other requirements quantitatively in terms of credit and qualitatively in terms of honor points. Often they recommend that every teacher give out grades in accordance with the so-called normal distribution curve or some other specific distribution curve more or less justified by experience; and sometimes that recommendation is so strong that it is considered mandatory by many teachers. The purpose of this research is to give a satisfactory answer to the following question and others like it. If every student takes three 5-credit courses a term and if every teacher gives out grades as indicated below,

Grades	A	B	C	D	F
Per cent	5	18	35	24	18

how many students may reasonably be expected to have an average of C or better for the term? In each class, 58 per cent of the students will have a grade of C or better. Does that mean that 58 per cent of the students may reasonably be expected to have an average of C or better for the term? This research is incomplete, but it has been carried far enough to answer that question emphatically in the negative.

DUNHAM JACKSON, Ph.D., Professor of Mathematics.

1. A Generalized Problem in Weighted Approximation. *Transactions of the American Mathematical Society*, 26:133-54. 1924.

It is well known that the terms of a Fourier series can be determined by the solution of a problem in least squares. A more general problem arises if different weights are assigned to different parts of the interval over which an approximation is sought. The convergence of the resulting series has been discussed by the writer and others, on the assumption that the weight function is always positive. This paper is concerned with the more difficult case in which the weight function is equal to zero at some points of the interval.



2. On the Method of Least  $n$ th Powers for a Set of Simultaneous Equations. *Annals of Mathematics*, 25:185-92. 1924.

The problem of the approximate solution of a set of equations by the method of least squares can be varied by using a different power of the error instead of the square. While it is not easy to carry through the resulting calculations explicitly, it is possible to prove certain general theorems about the character of the solution, which are presented under the above title.

3. On the Trigonometric Representation of an Ill-defined Function. *Annals of Mathematics*, 26:8-20. 1924.

This paper is concerned with a generalization of the method of least squares as applied to the determination of an average from a frequency function, and the approximate representation of the corresponding functional dependence by means of a trigonometric formula.

4. A General Class of Problems in Approximation. *American Journal of Mathematics*, 46:215-34. 1924.

This is a discussion of some of the problems of approximation which arise if the second power of the error, in the method of least squares, is replaced, not merely by a different power, but by a still more general function of the error. General theorems are proved with regard to the existence and determinateness of trigonometric and polynomial approximations under the conditions indicated, and their convergence as the number of terms is definitely increased.

5. The Trigonometry of Correlation. *American Mathematical Monthly*, 31:275-80. 1924.

It is shown that the formulas of plane and spherical trigonometry, as applied, by analogy, to the geometry of  $n$ -dimensional space, permit an interpolation of an ordinary coefficient of correlation as the cosine of an angle between two lines, and of a coefficient of partial correlation as the cosine of an angle between two planes, in such a way that important formulas connecting various coefficients of correlation can be written down almost immediately.

6. The Elementary Geometry of Function Space. *American Mathematical Monthly*, 31:461-71. 1924.

This paper presents in systematic and logically adequate form the deductions which in the preceding more elementary paper were based largely on analogy. The discussion is generalized at the same time, so as to show more clearly its relation to the theory of approximation by series of orthogonal functions, with which mathematical science has been much concerned during the past generation.

7. A Symmetric Coefficient of Correlation for Severable Variables. *Bulletin of the American Mathematical Society*, 30:536-42. 1924.

On the basis of the geometric interpretation mentioned above, this paper proposes a natural measure for the degree of dependence of three or more sets of observed quantities on each other, which differs from a coefficient of partial or multiple correlation in that the given sets of quantities all enter into the calculation in the same way.

8. The Geometry of Frequency Functions. *Bulletin of the American Mathematical Society*, 31:63-73. 1925.

The geometric basis for the theory of correlation is presented in a form which is appropriate if the data are not recorded as separate observations, but are grouped together in a manner indicated by a continuous frequency function.

9. The Dynamics of Correlation. Presented at a meeting of the Minnesota Section of the Mathematical Association of America, May 16, 1925.

It is shown that certain dynamical theorems relating to principal axes and ellipsoids of inertia have a direct bearing on the theory of correlation, leading to a geometrical representation which is supplementary to those discussed in the preceding papers.

10. The Theory of Approximation. A series of five lectures in process of preparation, to be presented at the Colloquium of the American Mathematical Society in the summer of 1925, and subsequently published in book form by the society.

The chief topics treated will be the theory of approximation by trigonometric sums and polynomials, the convergence and rapidity of convergence of Fourier and Legendre series, the theory of approximation in the light of generalizations of the method of least squares, the convergence of formulas of interpolation, and parts of the geometry of function space. There will be a systematic exposition of conclusions obtained by the writer and others during the past fifteen years, together with a large amount of new material, supplementing and extending the results of previous investigation.

11. See also the studies by E. Carlson, W. H. McEwen, M. M. Ness, and W. C. Risselman.

GLADYS GIBBENS, Ph.D., Assistant Professor of Mathematics.

### 1. Projective Differential Geometry.

Build up the congruences which are the line-geometric representations of a function of a complex variable and of its osculating linear fractional function. The focal surfaces of the latter congruence are two quadrics of positive curvature, which osculate the focal surfaces of the first congruence. Further, they are the canonical quadrics at the points on the focal surface corresponding to the point at which the linear fractional function osculates the arbitrary function.

### 2. Analysis.

A study of the approximation of a function  $F(x)$  by means of a polynomial of degree  $m$  in a function  $F(x)$ ; the convergence of this polynomial to  $F(x)$ .

ELIZABETH CARLSON, Ph.D., Instructor in Mathematics.

1. Extension of Bernstein's Theorem to Sturm-Liouville Sums. *Transactions of the American Mathematical Society*, 26:230-40. 1924. (Part of a thesis for the Ph.D. degree; Dunham Jackson, Adviser.)

The following theorem is proved in this paper. The maximum of the absolute value of the derivative of a Sturm-Liouville sum of order  $n$ , does not exceed  $n h M$ , where  $M$  is the maximum of the absolute value of the sum itself and  $h$  is a constant independent of  $n$  and of the coefficients in the sum. The corresponding theorem for finite trigonometric sums is due to S. Bernstein.

### 2. On the Convergence of Certain Methods of Closest Approximation.

Two particular types of approximating functions are chosen, and sufficient conditions for convergence are determined. This paper is also a part of a thesis offered for the Ph.D. degree in June, 1924. Since the first part of the thesis was published as a separate paper, considerable revision of the remainder has been necessary during the current year.

WILLIAM H. McEWEN, M.S., Assistant in Mathematics.

On the Approximation to the Solution of Differential Equations. (To be offered as a thesis for the Ph.D. degree; Dunham Jackson, Adviser.)

The problem concerns the approximate representation of the solution of a differential equation by means of a polynomial of given degree or a trigonometric sum of given order. Some theorems on the existence and the uniqueness of the approximating function have been established, and the question of convergence in the case of the first order differential equation has been considered.

WILLIAM C. RISSELMAN, B.A., Assistant in Mathematics.

The Geometry of Infinite Series. (To be offered as a thesis for the M.A. degree; Dunham Jackson, Adviser.)

A study by means of infinite series of the geometry of two- and three-dimensional sections of a space of an enumerable infinity of dimensions. Distance and angle have been established and other measures have been worked out.

MARIE M. NESS, M.A., Graduate Student.

A Statistical Study of the Grades in a Calculus Course. (Thesis for the M.A. degree; Dunham Jackson, Adviser.)

The problem was to determine the correspondence of results from various types of tests given the class, particularly new-type and old-type, to work out a theoretical basis for grades and some theoretical grades to be compared with grades as actually given. The material used was in the form of grades from carefully designed tests. The conclusions are drawn from results obtained by use of Pearson's product-moment correlations. The conclusions are (1) that while more theoretical and elaborate methods of grading lack some of the arbitrariness of the methods in practice, the results do not differ sufficiently to warrant the added labor; (2) new-type examinations can partially replace the old-type in calculus; and (3) a prognostic test on previous mathematics has a real predictive value for work in calculus.

## PHILOSOPHY

NORMAN WILDE, Ph.D., Professor of Philosophy.

The Ethical Basis of the State. Princeton: The Princeton University Press. 1924. 236 pages.

A study of the nature and limits of political obligation. It is concluded that sovereignty, in the sense of absolute and inalienable power, belongs to no social body, since society lacks the perfect moral community necessary to constitute such self-control. But the state, as the all-inclusive association, organized for the maintenance of the higher life, has a presumptive claim to sovereignty possessed by no other. The realization of the ideals of all other associations would still leave them particular and limited; the fulfillment of the idea of the state would give it, so far as the sphere of the external life is concerned, true universality and authority.

GEORGE P. CONGER, Ph.D., Assistant Professor of Philosophy.

1. The Doctrine of Levels. Read at the twenty-sixth meeting of the American Philosophical Association, Western Division, at Urbana, April 9, 1925. Published in the *Journal of Philosophy*, 1925.

With reference to current works by S. Alexander, C. L. Morgan, and R. W. Sellars, an attempt is made to frame a more precise definition of a metaphysical level; to enumerate about twenty-five levels which the world apparently exhibits; to describe

the passage from level to level (chiefly in terms of integration, or creative synthesis); and to summarize the points at which the doctrine of levels is of special importance for epistemology, metaphysics, and philosophy of religion.

## 2. A World of Epitomizations.

This book will present in more detail the argument outlined in the article "Evolution and Epitomization," which appeared in *The Monist* (1921), and developed more fully in *A Course in Philosophy* (1924). The hypothesis as it stands at present is formulated in four propositions: (1) the monads of various levels throughout the universe exhibit (a) relative individuations, (b) selective interactions, (c) reproductions, and (d) integrations; (2) cosmogony is epitomized by biology, and biology, in turn, by neuropsychology; (3) ecology is epitomized by physiological psychology; (4) the religious history of mankind is epitomized in the ethical experience of an individual person. The book will not be finished for at least three years.

## PHYSICS

HENRY A. ERIKSON, Ph.D., Professor of Physics and Chairman of the Department of Physics.

### 1. On the Nature of Ions from Hot Platinum.

These ions have been studied by a blast method whereby they were forced across a stream of air by means of an electric field and the current coming to a narrow electrode measured at different values of the potential gradient. It was found that there is only one negative ion formed. This ion has the same mobility in air as the negative air ion. It was also found that there is an initial positive ion which has the same mobility as the negative ion. The ion, however, changes into a final positive ion, the same as in the case of the positive air ion. A paper embodying above results and a discussion as to their mode of formation is ready for publication.

### 2. The Mobility of Argon Ions in Air. (Ready for publication.)

The ions were produced in argon by means of the alpha rays from polonium and the argon containing the ions was passed in a thin sheet above a stream of air. By means of an electric field the ions were passed from the thin sheet of argon through a stream of air to a plate where the current to a narrow strip was measured for different voltages. It is found that the negative argon ion has the same mobility as the negative air ion. It is also found that there is an initial positive ion which has the same mobility as the initial positive air ion. It is, furthermore, found that there is a second positive argon ion which has the same mobility as the final air ion. It thus becomes evident that an ion one atom large, such as the negative and initial positive argon ions, has the same mobility in air as an ion a complex molecule large.

### 3. The Isolation of Two Positive Bodies in Thorium and in Radium Active Deposits.

About 200 grams of thorium nitrate were dissolved in water. A stream of air was passed through the solution and into a large container, carrying with it the thorium emanation. From the container the air and active deposit formed passed in a thin sheet above a stream of air produced by a fan. By means of a field the active deposit ions passed from the thin sheet through the air stream and were deposited on a metal plate. The distribution on this plate was determined by placing it beneath an ionization chamber having a narrow opening in the bottom. When the distance along the plate was plotted against the current a curve having two maxima was obtained similar to that reported earlier in the case of the actinium active deposits. Similar results are obtained when the emanation from radium is used. There are, therefore, two positive active bodies present in the active deposit of thorium and radium, the same as was found earlier (*Physical Review*, 24:622, 1924) in the case of the active deposit of actinium. The author expects to be able to show that these bodies are singly and doubly charged.



JOHN T. TATE, Ph.D., Professor of Physics.

1. Note on the Absorption of  $\lambda_{2540}$  by Hg. Vapor. Abstract in *Physical Review*, 25:110. 1925.

Experiments show that freshly distilled Hg. vapor does not absorb the molecular band at  $\lambda_{2540}$  more strongly than older vapor. This indicates that Van der Linde and Wood's results showing stronger fluorescence in the fresh vapor are not to be accounted for by a greater concentration of those molecules which are responsible for the  $\lambda_{2540}$  band. Further experiments demonstrate that the molecules which are responsible for  $\lambda_{2540}$  are not heteropolar molecules formed between excited and neutral atoms, but are most probably true diatomic molecules,  $Hg_2$ .

2. Studies on the Absorption Spectra of Organic Substances in the Vapor State. (See abstract under W. H. Hunter.)

3. (With J. W. Buchta.) Loss in Energy of Electrons at Collision with Mercury Atoms.

To determine the loss in energy of an electron upon collision with a mercury atom, particularly when its velocity is above that necessary to produce ionization. A tube with suitably arranged grids is used and the velocity of the electrons after collision is measured by the retarding field they are able to penetrate. Preliminary measurements have been made but no definite results can be reported.

4. See also the studies by H. E. Hartig, J. W. Buchta, E. J. Jones, L. R. Maxwell, W. M. Nielsen, C. E. Nurnburger, and E. D. Wells.

LOUALLEN F. MILLER, Ph.D., Associate Professor of Physics.

1. A New Arrangement for Measuring Magnetostriction. *Physical Review*, 25:250. 1925.

A wire anchored to rigid posts at each end of a heavy slate slab about 10 feet long extends horizontally through a magnetizing solenoid, wound on a glass tube. The heat insulating power of glass delays the heating effect sufficiently to observe independent magnetostrictive values of current. The long solenoid is broken and separated at the center sufficiently to enable an optical lever to be rested upon the wire at this point. By means of the sag and the multiplication of the optical lever, using a lamp and scale, 1 mm. on the scale may be made to indicate about  $.87 \times 10^{-7}$  mm. change per mm. length of wire. For iron wire (.997 pure) a small decrease in length for the first small values of an increasing magnetic field is followed by an increase and then a decrease. When the magnetic field is reduced step by step to zero and then is increased step by step, iron shows no lag and gives the same form of curve in both directions. Pure nickel shows a continuous decrease in length as the field is increased, then returns with a lag and shows a reversal with lag as the magneto field is reversed. The data on tension and thermo-electric effects are as yet incomplete.

## 2. Magnetostriction.

Change of length of iron, nickel, and cobalt wires (paramagnetic elements) in a magnetic field as the strength of current producing the magnetic field is varied. Continuation of work reported at Washington meeting of American Physical Society. Other aspects of this same problem are under investigation.

## 3. Calcium Spectrum Investigations.

Pressure shifts in the calcium spectrum have been measured by the author with a comparator and published in the *Astrophysical Journal*, Volume 53, April, 1921. By use of the microphotometer these values can be checked and in addition the change in

energy distribution with pressure can be determined. The latter results may be more contributory than the pressure shifts.

HENRY E. HARTIG, Ph.D., Assistant Professor of Mathematics and Mechanics.

The Apparent Transmission of Low Velocity Electrons through Aluminum Foil. (Thesis for the Ph.D. degree; under the direction of J. T. Tate.)

Aluminum foil .0003 cm. thick was bombarded in vacuum by electrons having velocities from 0 to 1,600 volts. It was found that the emergent electrons had velocities of less than 10 volts, and could be divided into two groups (1) those of photoelectric origin, and (2) those which were apparently a transmitted fraction of the incident electrons. For incident velocities of about 8 volts a much larger number of electrons of the latter group were able to penetrate the foil than for velocities either higher or lower than 8 volts. The effect is somewhat similar to the transparent atom effect observed recently in the gases neon, krypton, and argon. A number of critical potentials characteristic of the spectrum of aluminum were located, and the method used for this work should prove useful in investigating the critical potentials of other metals.

JOHN H. VAN VLECK, Ph.D., Assistant Professor of Physics.

1. The Fundamental Concepts of the Quantum Theory of Line Spectra.

A monograph which will probably appear as a bulletin of the National Research Council, and which constitutes part of the report of the National Research Council Committee on Ionization Potentials and Related Subjects. The subject-matter consists of a survey and critique of recent developments in the Bohr theory of atomic structure.

2. The Absorption of Radiation by Multiple Periodic Orbits and Its Relation to the Correspondence Principle and the Rayleigh-Jeans Law, Parts 1 and 2, *Physical Review*, 24:330-65. 1924.

This article consists largely of a mathematical analysis establishing certain formal similarities between the discontinuous quantum mechanism of radiation and the continuous mechanism found in the classical electromagnetic theory of light. Part III on the equilibrium of orbits in classical black-body radiation will be published at a later date.

3. A Correspondence Principle for Absorption. *Journal of the Optical Society of America*, 9:27-31. 1924.

This is a preliminary account of the longer article on radiation listed above.

4. Half-Quanta and the Stability of Relativistic Orbits. Abstract in *Physical Review*, 25:108. 1925.

5. Virtual Oscillators and Scattering in the Quantum Theory. Abstract of paper presented before the American Physical Society. *Physical Review*, 25:242. 1925.

6. (With E. C. Hutchinson.) Half Quanta and the Specific Heat of Hydrogen. *Physical Review*, 25:243. 1925.

Abstract of the results of computations on the quantum theory of the specific heat of hydrogen which are being made by E. C. Hutchinson under the direction of J. H. Van Vleck as part of the former's thesis for the Ph.D. degree.

J. WILLIAM BUCHTA, Ph.D., Instructor in Physics.

A Low-Voltage Electron-Beam Oscillograph. *Journal of the Optical Society of America and Review of Scientific Instruments*, 10:581-90. 1925. (Thesis for the Ph.D. degree; J. T. Tate, Adviser.)

By placing a hot filament in a small enclosed space and arranging two diaphragms with small circular openings (0.07 mm. diameter) through which electrons could pass, a fine concentrated beam of electrons was obtained. This "electron gun" was placed in an evacuated tube, which, however, contained mercury vapor at a pressure corresponding to room temperature. The presence of the mercury vapor caused the electron stream to become luminous and to remain narrow and sharply defined for electron velocities above that corresponding to ionization. Such beams 20 cm. long were obtained with velocities corresponding to 30 volts. A study was made of the processes which resulted in the formation of this beam, and of the phenomena occurring in the tube. Photographs of the spectrum of the beam under various conditions were taken. The various uses of the beam were considered, especially its use as an oscillograph.

DAVID L. COOK, B.A., Teaching Fellow in Physics.

Efficiency of Electrons in the Ionization of Mercury Vapor. (Thesis for the M.A. degree; J. T. Tate, Adviser.)

The purpose is to determine the per cent of ionizing impacts between electrons of varying speed and atoms of mercury vapor. *Method*: Electrons from a tungsten filament are accelerated through holes in a grid into a space containing mercury vapor. The number of positive ions formed is measured as a function of the velocity of the electrons. *Results*: Tentative measurements seem to indicate that electrons having a velocity corresponding to about 300 volts are most efficient in ionizing mercury vapor.

ERNEST J. JONES, Ch.Eng., Teaching Fellow in Physics.

A Study of the Fluorescence in Mercury Vapor. (Under the direction of J. T. Tate.)

The purpose is to determine the nature of the fluorescing body which is so much more plentiful in freshly distilling mercury vapor than in older vapor. An absorption tube containing mercury vapor and fitted with suitable electrodes is used. Fluorescence is produced by illuminating with light from a spark discharge. The work is still in progress.

JOHN KRALOVEC, M.A., Teaching Fellow in Physics.

Permeability of Magnetite and Iron at Radio Frequencies. Abstract in *Physical Review*, 24:208. 1924. (Thesis for the M.A. degree; Gregory Breit, Adviser.)

Determination of variation with wave length of the magnetic permeability of magnetite and iron. A high frequency oscillator and resonator were used. The substance under investigation was inserted as a core in the coil of the resonator and its effect on the resonance observed. The permeability of magnetite was found constant over the wave length range of 50 to 1,000 meters. The results of Wwedensky and Theodortschik in the case of iron were verified.

LOUIS R. MAXWELL, B.A., Teaching Fellow in Physics.

The Mean Free Path of Electrons in Mercury Vapor. (Thesis for the M.A. degree. J. T. Tate, Adviser.)

The problem is to determine the mean free path of electrons at different speeds in mercury vapor; in particular, to investigate the variation in mean free path at low velocities and to determine whether there is any sudden change at the known

critical potentials of the mercury atom. The mean free path will be measured by determining the number of electrons scattered out of a beam of electrons passing through mercury vapor. The apparatus is set up but no results have yet been obtained.

WALTER M. NEILSEN, B.S., Assistant in Physics.

The Soft X-Rays from Mercury Vapor. (Thesis for the Ph.D. degree; J. T. Tate, Adviser.)

The purpose is to determine the nature of the radiation emitted by mercury atoms when bombarded by electrons having speeds greater than that corresponding to the ionization potential. A beam of electrons from a hot tungsten filament is projected along the axis of a copper gauze cylinder enclosed in a pyrex tube placed in a co-axial solenoid. The radiation produced in the region near the axis of the cylinder is incident upon a series of plates placed at an angle of forty-five degrees with the axis of the tube. The photo-electron current from these plates is studied as a function of the driving potential of the electrons. The work is in progress.

CARL E. NURNBURGER, B.A., Teaching Fellow in Physics.

Determination of Specific Charge of Positive Ions from (1) Disodium Phosphate and (2) Platinum. (Thesis to be offered for the M.A. degree; J. T. Tate, Adviser.)

The original purpose of the problem was the determination of ratio of charge to mass of ions emitted by  $\text{Na}_2\text{HPO}_4$  when heated in vacuo. At present the work is directed towards the identification of positive ions emitted by a hot platinum filament. The ratio  $e/m$  was determined in the usual way by deflecting a beam of positive ions in vacuo by a crossed magnetic and electric fields. A spectroscopic analysis of radiation emitted by the bombardment of mercury atoms by the positive ions is being made in the hope of identifying the latter. The positive ions emitted by  $\text{Na}_2\text{HPO}_4$  are the ionized atoms of sodium and possibly atoms of phosphorus. Platinum emits ions which are not characteristic of the element and whose identity is not definitely known. The work is in progress.

EVERETT D. WELLS, M.A., Graduate Student.

A Study of the Sensitivity and Characterization of a Low Voltage Cathode-Ray Oscillograph. (Thesis for the M.A. degree; under direction of J. T. Tate and J. W. Buchta.)

The purpose of this work was to determine the sensitivity and characteristics, especially at radio frequencies, of the oscillograph described by J. W. Buchta in the abstract entitled *A Low-Voltage Electron-Beam Oscillograph*. By using the low-voltage beam therein described, an oscillograph having a sensitivity of 15 mm. per volt difference of potential between deflector plates was obtained. The beam followed frequencies as high as  $6 \times 10^6$  cycles per second and still remained well defined.

## POLITICAL SCIENCE

CEPHAS D. ALLIN, LL.B., M.A., Professor of Political Science and Chairman of the Department of Political Science.

### I. Colonial Participation in Imperial Wars.

This study is intended to set forth the historical attitude of the several dominions on the matter of the various Imperial wars and to discover what political principles, if any, determined their action in the respective cases and to trace out the gradual development of a demand on their part of the right to participate in the determination of questions of war and peace and to formulate independent foreign policies of their own. This study is practically completed, in the case of Australia, down to the



time of the World War. The writer hopes to be able to visit Ottawa in the not distant future for the purpose of carrying on the corresponding study in the case of Canada.

2. See also the studies by F. D. Gray and N. Schochet.

WILLIAM ANDERSON,<sup>1</sup> Ph.D., Professor of Political Science, and Director of the Bureau for Research in Government.

1. American City Government. New York: Henry Holt & Co. To be published August, 1925. 665 pages.

An attempt to make a systematic presentation of the problem of government in American cities, with stress upon the process of government and some attention to the underlying social and economic conditions.

2. The Extra-territorial Powers of Cities.

A study of the legal conditions under which, and the extent to which, municipal powers may transcend municipal boundaries. Ready for publication.

3. Bureau for Research in Government.

Publication Number 4. Calendar of Minnesota Government, 1925. Compiled by Esther Crandall, B.A., Secretary of the Bureau. Minneapolis: University of Minnesota, October, 1924. 62 pages.

Although designed primarily as a ready reference book, this study was also an attempt to work out the legal sequence of events in Minnesota state and local government in a typical year.

Publication Number 5. The Minneapolis City Charter, 1856-1925. By Jessie M. Marcley, M.A. Minneapolis: University of Minnesota, June, 1925. 133 pages.

This study, first presented in 1924 as a Master's thesis, was enlarged and revised for publication in 1925. It gives a careful, concise history of the development of the Minneapolis city charter from the beginning, as well as a brief statement of recent reform proposals.

Because of the absence of the director during the greater part of the year, no important new research projects were undertaken by the Bureau. The following projects, begun in 1923-24, were carried forward and brought practically to a completion:

BRYCE E. LEHMAN, M.A.

County Government in Minnesota, with Special Reference to Hennepin, Ramsey, and St. Louis Counties.

Mr. Lehman has made this study substantially alone. The aim was not only to ascertain the legal provisions for county government in Minnesota, but also the methods and processes of county government in practice.

WELLES A. GRAY, M.A.

Municipal Indebtedness in Minnesota.

In 1923-24 Mr. Welles gathered the materials for this study partly for his Master's degree and partly for a special report to the League of Minnesota Muni-

<sup>1</sup> On sabbatical leave, 1924-25.

palities. Though absent from the University in 1924-25, he has given some time to revising his materials for possible publication by the bureau.

HAROLD S. QUIGLEY, Ph.D., Professor of Political Science.

1. Political Readjustment in China. *Yale Review*, 13:746-64. 1924.

A statement of conclusions as to political, economic, and social developments and tendencies in China, following residence and investigation in that country for two years, 1921-23.

2. The Chinese Constitution. *Chinese Social and Political Science Review*, 9:88-98. 1925.

A critical analysis of the constitution of China as promulgated on October 10, 1923. The document examined by chapters and discussed briefly with reference to its historical background in China and in comparison with Western constitutions of a similar type.

3. Government and Politics in the Far East.

A systematic presentation of the existing governments of Japan and China, together with some account of the constitutional history of each country and of the growth and present status of political parties. Work at present about half completed; to be published in book form.

4. See also the studies of C. W. Young, S. L. Anderson, A. N. Christensen, C. Y. Shill, and C. P. Heaton.

JEREMIAH S. YOUNG, Ph.D., Professor of Political Science.

1. City Planning and Restrictions on the Use of Property. *Minnesota Law Review*, 9:518-41, 593-637. 1925.

The article is in two parts. In the first part the writer called attention to the importance of the urban problem and the development of city planning, which is a new profession that is making rapid progress; outlined the leading subjects of a comprehensive plan for public property; sketched the methods of securing public property which include dedication, prescription, agreement or purchase, and eminent domain; outlined the methods of controlling and protecting public property which include private restrictions in deeds of transfer, advertising, regulating parks and street uses; granting of franchises to public utility corporations, use of eminent domain touching height, building lines, zoning, and excess condemnation, and their constitutionality in the light of recent court decisions. The entire first part of the article was devoted to a discussion of city planning and restrictions on property in its public aspects.

In the second part, the center of interest has been city planning and restrictions on the use of private property. The writer pointed out the bad results from lack of regulating the use of private property and discussed some of the partially successful expedients such as restrictions in deeds, unregulated official action and eminent domain that were tried in order to solve the difficulties; explained the nature of the police power; traced the beginning of government restrictions on the use of private property and raised the question whether city planning can make use of the police power; traced the purposes of the police power; and then applied police power principles to city planning on such subjects as replotting and zoning to include building lines, height, area or bulk, and use districts; and under this latter heading called attention to the various uses of buildings for residence, business, and industry, pointing out how various exclusions are used for the protection of these different uses; took a cursory glance at aesthetics as a subject for treatment under the police power; and finally, treated the subject of zoning procedure and judicial interpretation.

2. See also the studies by A. V. Johnston and A. M. Tollefson.

MORRIS B. LAMBIE, M.A., Ph.D., Associate Professor of Political Science;  
Chief of Municipal Reference Bureau, General Extension Division.

### Civil Service Problems.

The work should be ready for publication in about one year. The contents are suggested by the following chapter heads:

(1) Source of the Power of Appointment. (2) The Interest in Civil Service Management in England. (3) Classification of Positions To Determine Recruiting Methods. (4) Suggestions from English and American Practices Relating to Entrance to the Civil Service. (5) Promotion. (6) Salary Determination. (7) Power of Removal. (8) Training for the Public Service. (9) Rights and Privileges, with Special Attention to the Problems of Political Activity and Employees' Associations. (10) The Administrative Departments Having Control over Personnel Problems. (11) Conclusion.

HAROLD F. KUMM, M.A., LL.B., S.J.D., Assistant Professor of Political Science.

1. Mandamus to the Governor in Minnesota. *Minnesota Law Review*, 9:21-53. 1924.

An examination of the cases, federal and state, dealing with the question of judicial control of the governor through the writ of mandamus. It is concluded that the weight of authority is in favor of the governor's exemption from the writ, though a logical and teleological approach would demand this officers's subjection to mandamus.

### 2. The Railroad and Warehouse Commission of Minnesota.

To constitute a book or a series of articles on the history, organization, and functions of the Railroad and Warehouse Commission of Minnesota. The principal sources for this work are the reports of the commission and of the state supreme court. A special effort will be made to sketch the development of an administrative technique on the part of this agency.

### 3. Unconstitutional Legislation in Minnesota.

To be a law review article on the statutes thus far declared invalid by the Supreme Court of Minnesota. The material for this article is to be gathered from the state statutes and supreme court reports. The decisions will be classified to indicate what constitutional provisions have been most often used as a basis for invalidating statutes.

ARNOLD V. JOHNSTON, M.A., Instructor in Political Science.

Constitutional and Legal Aspects of National Prohibition. (Thesis for the Ph.D. degree; J. S. Young, Adviser.)

The purpose of the thesis is to gather together and analyze the constitutional and legal points bearing upon the problems of national prohibition of the liquor traffic in the United States. It is hoped that conclusions can be drawn of a constructive character, embodying a proposed national prohibition policy. Practically all the original source material will consist of statutes and legal decisions. Secondary material will be obtained chiefly from legal periodicals. The following topics are included:

(1) State and local prohibition prior to the Eighteenth Amendment—an introductory sketch. (2) Relation of state prohibition to the federal constitution—conflict of prohibitory legislation with the commerce clause, the Fourteenth Amendment, etc.; legal difficulties paving the way toward national prohibition. (3) The Eighteenth Amendment—adoption of; validity of. (4) The Volstead Act and federal enforcement; statutes and administrative regulations. (5) State enforcement statutes—analysis of the concurrent legislation of the various states. (6) The doctrine of concurrent powers, as applied to prohibition; state and municipal statutes and ordinances; conflict of

laws. (7) Legality of means and methods of enforcement—search and seizure; legal evidence; penalties. (8) Legalized uses of alcohol—non-beverage purposes; practice of medicine and of pharmacy under prohibition. (9) A national prohibition policy—suggestions for extension or amendment, based on conclusions derived from a study of legal difficulties involved in the present policy.

C. WALTER YOUNG, M.A., Instructor in Political Science; Willard Straight Research Fellow to China for a period of three years beginning September, 1925, under the auspices of the Institute of International Education.

1. A Study of Russian Policy in Manchuria from 1895 to 1904. (Thesis for the M.A. degree; H. S. Quigley, Adviser.)

An analysis of the development and character of Russian policies in Manchuria under the following subject heads: (1) Russian loans to China and the Russo-Chinese Bank; (2) Russian railway policies in Manchuria; (3) control of customs administration; (4) Russian land leases and control of administration; (5) the military position of Russia in Manchuria; and (6) a critical summary of the development of Russian policies in Manchuria from 1895 to 1904.

The method is topical or subjective, rather than chronological or historical, the historical treatment of each subject being incidental to the analytical. The materials used were principally government documents, diplomatic and consular, personal memoirs of interested personalities, vernacular periodicals and newspapers for opinion, and selected from Russian, Japanese, British, American, French and Chinese sources. An expansion and epitome of the results of this research is published in the *Chinese Students Monthly*, May, 1925, under the title of "The Russian Advance into Manchuria."

2. Japanese Policy in Manchuria with Special Reference to the Open Door. (Thesis to be offered for the Ph.D. degree; H. S. Quigley, Adviser.)

The purpose is to present and evaluate the development and character of Japanese political and commercial policies in Manchuria from the Chino-Japanese war of 1895 to the present time. The treatment of the subject will parallel that of the thesis described above. Three years residence in China, particularly in Peking and Manchuria, will be used to obtain further information on the subject. The method, as in the case of the thesis described above, is topical or subjective, rather than chronological or historical, the historical treatment being incidental to the analytical. The materials used are primarily government documents, diplomatic and consular, of Japan, the United States, Great Britain, China, Russia, and France. Personal memoirs and vernacular periodicals and newspapers will be drawn upon for facts and opinion.

SHERMAN L. ANDERSON, M.A., Assistant in Political Science.

The Attitude of the United States towards Arbitration—1794 to 1872. (Thesis for the M.A. degree; H. S. Quigley, Adviser.)

Arbitration was employed to determine claims and boundary controversies. The general form of arbitration was the mixed commission form. There were variations in the details of this form, and an occasional resort to arbitration by a foreign sovereign. The arbitral practice was a mixture of the judicial and the non-judicial elements. Arbitration was discretionary and not compulsory. The United States appointed her own nationals as her commissioners, and in some cases men who had had previous political connection with the issue in controversy. The political concern of the United States with particular arbitration cases varied in proportion as the national interest or sensitiveness of the United States might be involved. Remarkable anticipations of present day proposals for international organization were made during the period, such, for instance, as William Ladd's proposal for a Congress of Nations and a Court of Nations. In general, the United States had an extensive experience with arbitration during the first century of its history. Its experience had been, for



the most part, felicitous, and seemed to foreshadow a closer relation and sympathy with arbitral development than that which actually exists to-day.

ASHER N. CHRISTENSEN, B.A., Assistant in Political Science.

The Influence of American Missionaries and Missionary Organizations upon American Policy in China. (Thesis for the M.A. degree; H. S. Quigley, Adviser.)

An historical and critical study of the influence of American missions upon American policy towards China in the nineteenth century; materials used principally the documents in the American Foreign Relations Series and in missionary reports and other publications. Work in progress.

BRYCE E. LEHMAN, M.A., Shevlin Fellow in the College of Science, Literature, and the Arts.

1. County Government in Minnesota. (See abstract under W. Anderson, Bureau for Research in Government.)

2. City-County Consolidation in the United States.

To present the problem of duplication of activities as between large cities in the United States, suburban municipalities, and counties, and to compare methods of solution adopted are the principal objects of this study, which may also be enlarged into a doctoral dissertation.

3. Bibliography of Minnesota Newspapers.

This project is planned to include a brief sketch of the history of every newspaper published in Minnesota prior to January 1, 1901. The location of every extant file which can be found, and a list of the files of each newspaper in the library of the Minnesota Historical Society with gaps and missing issues enumerated will comprise the bibliography.

4. See under William Anderson, Bureau for Research in Government.

NAHMAN SCHOCHET, B.A., Assistant in Political Science.

The Minnesota Supreme Court, 1858-1865. (Thesis to be offered for the M.A. degree; C. D. Allin, Adviser.)

The paper deals with Minnesota's first State Supreme Court, the emphasis being placed upon the personal and historical background of the court rather than upon the legal significance of its work. Starting with the admission of Minnesota as a state, taking up the work of the constitutional conventions, the lives of the judges are then treated up to 1858, providing the personal background for the study. The contemporary history is then treated, in an effort to show the conditions under which the court worked,—the financial panic, the political situation, the effects of the Civil War and the Indian uprisings, concluding with the immediate background of the court. Through personal interviews, largely, material is being collected concerning such factors as library facilities and court procedure. The study brings out the hectic conditions of the period, showing the difficulties under which the court worked, and that Minnesota was fortunate in that the foundations of her jurisprudence were laid down by such men as Emmett, Atwater, and Flandrau.

CHAO Y. SHILL, M.A., Albert Howard Scholar.

Interstate Treaties in Ancient China, 722-468 B.C. (Thesis for the M.A. degree; H. S. Quigley, Adviser.)

A study of international agreements in ancient China, pointing out that more than 130 treaties were found in authentic history of these two hundred and seventy

years, that these treaties dealt with a vast variety of subjects, ranging from peace, amity and commerce to regulation of highways, rivers, and staple products, succession to thrones, women in politics, and disarmament. The sanctions for these agreements were not only religious, but also political and legal.

ESTHER CRANDALL, B.A., Librarian of the Municipal Reference Bureau.

(See under William Anderson, Bureau for Research in Government.)

FRANKLIN D. GRAY, Undergraduate Student.

American Occupation of Haiti. (Under the direction of C. D. Allin.)

This thesis deals with the question of historical incidents connected with the original occupation of this country, the policy which has been pursued by our government in the course of its occupation, the criticisms of this policy, the accomplishments of the American administrators, and suggestions for the future control and government of the island.

WELLES A. GRAY, M.A., Graduate Student. (See under William Anderson, Bureau for Research in Government.)

CLARENCE P. HEATON, M.A., Graduate Student.

The Policy of the United States Regarding the Application of Extraterritoriality in China. (Thesis for the M.A. degree; H. S. Quigley, Adviser.)

An historical and critical study of the topic of the theory and practice of extraterritoriality as observable in China, from the standpoint of the government of the United States. Material used: the documents of the executive, legislative, and judicial departments of the American government, the extraterritorial cases of the American Court for China and the American and foreign periodicals, as well as secondary works where they are available. Work in progress.

JOSEPH R. PRATT, B.A., LL.B., Undergraduate Student.

Special Assessments in Minnesota.

This work is a compilation and annotation of all the laws now in force in the State of Minnesota dealing with the levying and collection of assessments for local improvements. It deals with laws affecting cities of the first, second, third, and fourth classes and villages. The work is based on Art. 9, Sec. 1 of the *Constitution of Minnesota—Power of Taxation*—and some 350 laws now in force in this state. This treatise is designed to clarify the statutes on this particular subject so that such information may be easily accessible to municipal officials or anyone seeking information on special assessments for local improvements.

AXEL M. TOLLEFSON, M.A., LL.B., Graduate Student.

Judicial Review of Administrative Decisions by the Federal Courts. (Thesis for the M.A. degree; J. S. Young, Adviser.)

The main purpose has been to show which actions, determinations or decisions, of certain federal administrative tribunals are conclusive and which are reviewable and to what extent the latter are reviewable in the federal courts. Owing to the many administrative tribunals with their respective and varied functions not many valuable rules can be deduced which will hold in every case. Certain general rules, however, may be stated with more or less accuracy as follows: Decisions of administrative tribunals are always reviewable where the requirements of due process of law have not been observed; where the tribunal acted outside of the scope of its jurisdiction; and

where the decision is tainted with fraud. Furthermore, if the above objections are absent such decisions are generally conclusive as to findings of fact. Also it would seem that where the question is one of mixed law and fact they are conclusive unless the ruling upon the law and findings of fact can be separated and it can be shown that the error is one of law. Finally these decisions are reviewable where there has been an erroneous application of law.

## PSYCHOLOGY

RICHARD M. ELLIOTT, Ph.D., Professor of Psychology and Chairman of the Department of Psychology.

### Investigations of Mechanical Ability.

By the Mechanical Abilities Research Staff (Research Assistant Professor L. Dewey Anderson; Research Assistants H. A. Edgerton, Ruth Gullette, and Gennette Ulvin; Consulting Statistician, H. A. Toops and assistants) under the direction of Professors D. G. Paterson and R. M. Elliott.

This research is subsidized by an annual grant of \$8,200 from the National Research Council, Committee on Human Migrations. The plan includes (1) analysis of mechanical aptitude or ability; (2) analysis of hereditary and environmental factors determining various mechanical abilities; (3) investigation of the significance and validity of mechanical aptitude tests.

The analysis of results pending will be published on an extensive scale. The data include: (1) intensive study by test methods of 217 twelve-year-old boys in vocational departments of Jordan Junior High School to select from 27 tests a battery comprising those most diagnostic of mechanical aptitude; (2) study of an additional group of 150 subjects similarly selected using selected battery of tests; (3) development of an adequate criterion against which to check tests.

DONALD G. PATERSON, M.A., Professor of Psychology.

(With T. A. Langlie.) Empirical Data on the Scoring of True-False Tests. To be published in the *Journal of Applied Psychology*.

The purpose is to test the assumption that the effects of guessing in two alternative response tests are counteracted by a right minus wrong scoring formula resulting in higher reliability and validity coefficients when such a formula is used than when such tests are scored number right or number wrong. Reliability and validity coefficients were computed for three scoring methods for 100 item true-false tests in two college classes and the reliability coefficient was computed for the three scoring methods for a 100 same-opposites tests given to 519 sophomores.

*Results.*—Scoring by number right results in uniformly higher reliability coefficients regardless of whether the two alternative response tests are given with or without a time limit and regardless of whether the students are told to guess or are warned not to guess. These results are contrary to the assumptions which have been made in urging the use of a right minus wrong formula. Detailed summary of the results is given under eight headings bringing out other minor points in the paper.

2. Analysis of Objective Examinations in Elementary Psychology. Appendix B of the author's book: *The Preparation and Use of New Type Examinations*. Yonkers, New York: World Book Company. (To be published.)

The purpose is to add to present knowledge concerning relative values of different methods of measuring student achievement in such a college course as psychology.

The method was to obtain correlations and intercorrelations between each grade component and final grade in the course for various classes.

*Results.*—The interpretation and significance of such correlational work are accompanied by a complete description of all of the grade components. The evidence indicates the high reliability of the objective examinations as developed in the elementary psychology courses.

### 3. Analysis of Intelligence Tests Given to Freshmen at the University of Minnesota.

A study of the effectiveness of each test singly and in combination as a measure of scholastic ability, discarding weak tests and adding new tests for trial. The method used was to compute the correlation between each test and scholastic achievement for successive classes of freshmen, determining the effect on the correlations of such factors as sex, geographical origin of students, necessity of self-support, age of students, date of graduation, etc. Developing methods of building increasingly diagnostic tests.

*Results.*—The gradual development of a battery of tests, each predicting scholastic achievement to as great an extent as the unreliability of scholarship measures and the existence of non-intellectual factors in achievement will permit. The accumulated data are being filed subject to assembly and systematic interpretation and publication after a period of five years. This work is now in its fourth year.

### 4. Development of Methods of Evaluating the Orientation Course.

The purpose is (1) to develop methods of predicting achievement in the Orientation Course; (2) to measure the reliability and validity of the various devices used in measuring achievement in the course; (3) to measure the effectiveness of sectioning on the basis of ability; (4) to measure the extent to which the course is realizing its aims.

At the end of each course, intelligence tests and a specially devised placement test are given to all new students, traditional and new type examinations are given, and questionnaires are given to each student. The data so obtained are subjected to statistical analysis to determine the relationships between the variables involved. Publication will be delayed until the results for three years are available, at which time a complete report will be published.

### 5. (With H. A. Edgerton.) Tables of Standard Errors and Probable Errors of Percentages for Varying Numbers of Cases. (To be published.)

These tables are prepared to facilitate the computation of standard errors and probable errors of percentages with the number of uses varying between twenty-five and one million. The tables give the standard errors and the probable errors to three decimal places and the square of these for each of the possible proportions, the number of entries in the tables being 7,000. The tables have been used in three research studies and have simplified detailed analyses which would have involved an almost prohibitive amount of time and drudgery.

### 6. Factors Contributing to a Knowledge of Advertising Slogans. (See abstract under K. E. Ludgate.)

7. See also studies by T. A. Langlie, Ruth Hubbard, Marion Myer, G. E. O'Brien, and G. Ulvin.

WILLIAM S. FOSTER, Ph.D., Professor of Psychology.

### 1. (With Earl Hudelson and others.) Investigation of the Effect of Class Size upon Teaching Efficiency.

Problem undertaken by members of a subcommittee at the request of the University Committee on Educational Research. A preliminary report on methods and



progress was made to that committee in February, 1925, and some account of the work thus far accomplished was given to the Minnesota Society for the Study of Education at their annual meeting by Professor Hudelson (see *Minnesota Daily*). The particular investigation here described covers the work accomplished in Psychology 1f-2w, by students in recitation sections of 30 as compared with that of students of equivalent intelligence and previous scholarship who met in sections of 60. Results thus far obtained show no significant differences in the average accomplishment in the large and small sections in psychology. In different quarters and with different instructors the differences may favor the small or the large section, but no difference greater than 6 per cent has yet appeared.

## 2. Minor Studies in Psychology. (Under the direction of W. S. Foster.)

These studies are made both by undergraduate and by graduate students, usually before the experimental thesis for an advanced degree is begun.

1. Marie Ness (graduate student) and Dorothea McCarthy (senior student) are co-operating in an investigation of the reliability and validity of the Seashore Tests of Musical Talent. Correlations between repeated tests and between test scores and estimates of musical ability for over 100 adults, chiefly university students, show reliabilities ranging from .60 to .90. Pitch and musical memory appear to have greatest significance and validity. Teachers' estimates of musical ability and test scores of 75 fifth and sixth grade children and of nearly 100 seventh grade children have been obtained. Certain data on relations between musical ability and intelligence are also collected, but the data on children have not yet been summarized.

2. Several other minor problems, not yet sufficiently complete to report upon save by title have been undertaken by Marnie Lauritsen (graduate) on the attention value of colors as measured by different methods; by Willard Olson (graduate student) and Gladys Marvin on memory for intentionally learned *vs.* memory for unintentionally learned materials; by Harold Carter (senior student) and Marshall Barton (senior student) on the validity of different types of "objective" examinations; by Dyrel Kirk (senior student) on *Aussage* for pictures *vs.* events, with a consideration of the validity of Stern's coefficients of testimony and of the constancy of measure of memorial ability; by Bella Waisbren (senior student) on the relationship between college grades and social status. Whether or not the methods adopted in these latter problems, and whether or not the time and other facilities for carrying out experimentation will yield dependable results, can not yet be stated.

KARL S. LASHLEY, Ph.D., Professor of Psychology.

1. Studies of Cerebral Function in Learning. V. The Retention of Motor Habits after Destruction of the So-Called Motor Areas in Primates. *Archives of Neurology and Psychiatry*, 12:249-76. 1924.

2. Studies of Cerebral Function in Learning. VI. The Theory That Synaptic Resistance Is Reduced by the Passage of the Nerve Impulse. *Psychological Review*, 31:369-75. 1924.

3. A Series of Studies Dealing with the Relationship between the Extent of a Cerebral Lesion and the Severity and Duration of the Symptoms Produced. (In progress.)

It has been held, without convincing evidence, that intelligence is related to the ratio of brain and body weights, that amentia is due to the reduced number of functional cells within the cerebral cortex, that the probability of recovery from the effects of cerebral injury in man is somewhat dependent upon the extent of the injury. The studies reported below represent an attempt to define more accurately these quantitative relationships between cerebral mass and intelligent behavior.

1. Measurement of the learning ability of rats after destruction of more than half of the cerebrum. Such extensive injuries affect the learning of simple habits but little, whereas ability to form more complex habits is greatly reduced.

2. The correlation between the total area of smaller cerebral lesions and ability to form various habits. With lesions involving from 5 to 40 per cent of the entire cerebral cortex of the rat, no correlation between the extent of the injury and the rate of learning of motor or visual habits has been found.

3. The influence of the extent of an injury in the visual area to the retention of visual habits formed before the injury. (With the assistance of Dorothy Hunter and L. E. Wiley.) A correlation of 0.85 has been found between the number of errors made by rats in relearning visual discrimination after lesions to the occipital cortex and the total area destroyed.

4. The influence of the extent of cerebral injury upon the retention of motor habits.

5. A review of the literature on aphasia to determine the relation between the extent of injury and the time required for recovery in man. For the cases thus far accumulated a correlation above 0.80 has been found.

4. (With Carlyle Jacobsen.) Measurements of the Learning Ability of Monkeys before and after Destruction of the Frontal and Parietal Association Areas.

Complete destruction of the frontal lobes has no effect upon learning ability or the retention of habits formed before the cerebral injury. The study is being extended to determine the amount of destruction necessary to produce reduction of learning ability by combining lesions in the parietal, frontal, and temporal areas.

5. See also the studies by Carney Landis, A. M. Thorson, J. M. Ball, Allan Challman, and R. W. Erickson.

HERBERT WOODROW, Ph.D., Associate Professor of Psychology.

#### 1. Character Training Test for Children of Ages Six to Ten.

The object is to devise, for young children, a test of the efficiency of those reactions usually included under the term character. The method used is to rate children by their responses to a series of twelve sets of pictures, each of which sets forth either a good or a bad aspect of behavior. Of course, to begin with, the pictures must be carefully devised. They were sketched from imagination and from photographs of posed situations. Over one hundred pictures were tried out individually over a period of two years on about one hundred school children who had been previously rated in character by their teachers. Forty-eight pictures were finally selected as showing a difference between the good and bad children and printed in pamphlet form, so that a further trial could be made by the group test method. About six hundred children have now been tested. Two hundred and fifty of these were also given individual intelligence tests. Correlations of scores on the picture test with teachers' estimates and intelligence and various other statistical matters are now being worked out.

#### 2. Individual Differences in Emotionality.

The object of this research is to determine whether the electrical changes in the human body, which occur under influence of emotion, are of value in the study of individual differences. The method consists in correlating changes in resistance produced by a definite set of stimuli with estimates of associates concerning emotionality. This correlation has been found high, but not as high as desirable for diagnostic purposes because of exceptional cases. A marked sex difference has been noted, the females showing a reliably greater electrical change to emotional stimuli.

### 3. Unevenness in Mental Development.

The object is to determine to what extent different mental functions may vary in their rate and degree of development in the same child, to obtain norms of the amount of existing unevenness, and to determine the limits of normal unevenness. There are various subsidiary problems involved. The method consists in giving tests of six different mental functions to fifteen hundred children of fifteen different ages, and studying, by means of statistical methods, the inequality in development of each child. At present the work has reached the stage of tabulating the nine thousand scores obtained in the manner mentioned above, as a preliminary to various statistical computations.

CHARLES BIRD, Ph.D., Assistant Professor of Psychology.

#### 1. The Relative Importance of Maturation and Habit in the Development of an Instinct. *Pedagogical Seminary and Journal of Genetic Psychology*, 22:68-91. 1925.

By using a control group of fifty chicks, which were allowed natural feeding, and for comparison several groups of chicks, which were forced-fed and prevented from pecking at grains except during a series of twenty-five test trials made each day, an attempt was made to determine the influence of physiological development and of practice on the accuracy of swallowing. The experiment was conducted for each group over a period of twenty-five days. The results obtained indicate: (1) the initial accuracy of chicks which are prevented from pecking at grains for periods of seven days is no greater than that of one-day-old animals on their first trial; (2) chicks which are allowed only twenty-five reactions a day to grains show no improvement in accuracy of swallowing after the third day; (3) as soon as forced-fed chicks are allowed natural feeding they approximate the accuracy of naturally-fed chicks their own age; (4) general physiological development practically determines the accuracy of hitting but not of swallowing grains; and (5) the accuracy of the swallowing reaction of chicks is determined chiefly by practice.

#### 2. The Influence of Physiological Development during the First Twenty-four Hours upon the Pecking Reactions of the Chick.

The accuracy of the pecking reactions of a group of twenty-eight chicks, during periods ranging from two to eighteen hours after hatching, was measured and compared with records obtained from a group of seventy chicks tested for the first time when thirty hours old. Since neither group had opportunity to react to grains before the testing periods it was possible to measure the influence of physiological development upon accuracy. The results obtained verify two hypotheses previously expressed by the writer: (1) the effect of physiological development is to stabilize and determine the accuracy of striking at grains; and (2) practice is necessary to increase the accuracy of seizing and swallowing grains.

#### 3. An Experimental Study of the Natural Development of the Pecking Reactions of Chicks.

Sampling curves representing the increasing accuracy of the pecking reactions of a group of fifty chicks, kept under natural feeding conditions, were derived each day during a period of twenty-five days. An objective record of the development of an instinctive response was thus obtained; the characteristics of such development were graphically represented. Coefficients of correlation thus far determined indicate that chicks which are most accurate on the initial trials tend to keep their relative positions in the group at the end of the twenty-fifth day.

EDNA HEIDREDER, M.A., Instructor in Psychology.

1. An Experimental Study of Thinking. *Archives of Psychology*, 73:1-175. 1924.

Each subject was confronted with a series of novel situations to each of which he was required to react overtly in some way, and to continue to react until he had discovered the correct response. The problems were so arranged that each overt reaction automatically recorded itself, and this record, in addition to the reaction time of each response and the subject's verbal report of the process, constituted the original data. On the basis of 180 records secured in this way, the following results were obtained:

1. There are two general ways of attacking a problem, "participant" and "spectator" behavior. The former consists in definitely advancing and trying out hypotheses; the latter in refraining from active participation and permitting impressions not specifically attended to, to be registered and to gain distinctness, apparently by a process of summation.

2. Success, as well as failure, may be important in stimulating thought. Concrete successes or partial successes, occurring during the course of a problem, were found to have a specifically stimulating effect on some of the more complex processes involved in thinking.

3. There is no special process or combination of processes to correspond to the term "thinking." "Thinking" is a collective term, and does not represent a unitary activity. The word is apparently derived from an observation of results rather than processes; i.e., when certain results are produced in certain conditions, it is assumed that thinking has taken place.

2. A Statistical Analysis of Freyd's List of Introvert Traits.

This study was an attempt to try out Freyd's list of fifty-four introvert traits in two ways: (1) to test the list itself, to see whether the traits included actually differentiate between introverts and extroverts; (2) to see what results it gives when used as an instrument for the statistical analysis of a group of normal individuals.

The fifty-four traits were used as a rating scale which was presented, with the necessary instructions, to the students in General Psychology. Each student rated himself and secured ratings of himself from two other persons. A random sample of 200 individuals, 100 men and 100 women, was chosen as the basis of the study. This material was analyzed statistically and the following results were obtained:

1. Freyd's list, with the exception of seven traits, was justified in the sense that it revealed statistically significant differences between the 25 per cent most introverted and the 25 per cent most extroverted individuals of the group.

2. The group did not fall into two distinct classes, introverts and extroverts, but into a single group having the general form of a probability curve, the extremes of which might be taken to represent introversion and extroversion.

3. The central tendency of the group was not a perfect balance between introvert and extrovert traits, but eleven units in the direction of extroversion.

4. A significant difference was obtained between self-ratings and associates' ratings. Though both tended in the direction of extroversion, the average of the self-ratings indicated more introversion than that of the associates' ratings.

3. Intelligence and the Height-Weight Ratio.

The purpose of this study was to follow up the work of Naccarati, who found slight positive correlations between intelligence scores and height-weight ratios. In the present study, it was possible to use larger and less selected groups than those Naccarati found available. Scores in various intelligence tests and height-weight ratios were obtained for 1,000 individuals, 500 men and 500 women. The study has not been completed, but the correlations obtained so far do not confirm Naccarati's conclusions.



CARLYLE JACOBSEN, M.A., Instructor in Psychology.

1. The Relation of Functional Localization on the Cerebral Cortex of the Rat to the Finer Histological Structure of the Cortex. (Thesis for the Ph.D. degree; K. S. Lashley, Adviser.)
2. A Comparison of the Behavior of Young Children with that of Monkeys, in the Solution of Various Simple Puzzles.
3. See also study listed under K. S. Lashley.

HEINRICH KLÜVER, Ph.D., Instructor in Psychology.

1. Psychological and Sociological Types. *Psychological Review*, 31: 456-62. 1924.
2. Begabungsdifferenzierung im ersten Schuljahr. *Zeitschrift für angewandte Psychologie*, Beiheft 34:1-49. 1925.
3. Psychologische Bemerkungen zum Bilderbogentest. *Ibid.*, Beiheft 34:50-60. 1925.
4. The Problem of Type in "Cultural Science Psychology." *Journal of Philosophy*, 22:225. 1925.

The following are in press or ready for publication:

5. An Analysis of Recent Work on the Problem of Psychological Types.
6. The Determination of Types with an Experimental Study of the Eidetic Type.
7. An Experimental Study of the Eidetic Type.
8. A Review of the Literature on the Eidetic Type.
9. "Historical" versus "Mental" Tests.
10. The Importance of Max Weber's "Ideal Type" for Psychology.
11. Translation of the Theory of the Constancy of Intelligence, by William Stern.
12. (With Carney Landis.) Translation of the Technique of Hypnosis, by A. Kronfeld.

13. Research in progress:

1. Experimental work as follows:

- (a) The influence of apsychonomic factors upon the size of after-images;
- (b) the influence of form upon the size of after-images in isodiastatic and heterodiastatic constellations;
- (c) experiments on "Eidetiker" (adults);
- (d) experiments as to the existence of Krellenberg's "unitary type" in pre-school age;
- (e) various questions of Gestalt perception in monkeys and children.

2. Theoretical work as follows:

- (a) Some questions concerning the phenomenology and logic of "primitive" thinking;
- (b) The problem of Gestalt in social science;
- (c) The ambiguities of "phenomenological psychology";
- (d) The personalistic elements (in Stern's sense) in Troeltsch's *Historismus*.

KATHERINE E. LUDGATE, Ph.D., Instructor in Psychology.

### I. The Effect of Manual Guidance upon Maze Learning.

The purpose was to determine (1) whether guidance of the stylus in the learner's hand over the correct pathway of a pencil maze, by the experimenter, exerted any effect upon the learning of the maze; (2) whether such guidance was more effective than the same number of uncontrolled trials; (3) the optimum number of controlled trials; (4) the position in the learning where the controlled trials were productive of the best results; (5) the variation in effectiveness with different mazes; (6) the effect of guidance upon the mastery of subsequent acts of skill. *Material*: 2 stylus mazes; 255 university students at the University of Chicago.

*Results*.—(1) Guidance was effective in all cases. (2) The amount of guidance productive of the best results was a function of both the maze and the criteria employed. (3) The position of the guidance productive of the best results was an early stage in the learning, but not the initial stage. (4) The efficacy of the guidance was a function of the maze activity.

### 2. (With D. G. Paterson.) Factors Contributing to a Knowledge of Advertising Slogans.

The purpose is to determine the relationship between a knowledge of advertising slogans and such items as intelligence, number of newspapers read, number of times individuals ride on street cars, etc. *Material*: Tests of recall of advertising slogans, questionnaires including twelve factors which might be related to this ability and an intelligence test. Approximately 150 university students were tested. Results not yet statistically treated.

CARNEY LANDIS, Ph.D., National Research Council Fellow in the Biological Sciences.

1. Studies of Emotional Reactions. I. A Preliminary Study of Facial Expression. *Journal of Experimental Psychology*, 7:325-41. 1924.

2. Studies of Emotional Reactions. II. General Behavior and Facial Expression. *Journal of Comparative Psychology*, 4:447-509. 1924. (Thesis for the Ph.D. degree; under the direction of K. S. Lashley.)

3. The Justification of Judgments. *Journal of Personnel Research*. May, 1925.

4. The Criteria of Emotionality. *Pedagogical Seminary*. June, 1925.

5. Studies of Emotional Reactions. III. Blood Pressure and Inspiration-Expiration Ratios. *Journal of Comparative Psychology*. (In press.)

6. (With L. E. Wiley.) Changes in Blood Pressure and Respiration during Deception. (Ready for publication.)

An investigation of blood pressure changes (Erlanger method) and inspiration-expiration ratios under conditions of experimental deception.

7. (With H. Klüver.) Translation of the Technique of Hypnosis, by Kronfeld (Psychopathologie).

8. Changes in Blood Pressure during Sleep As Determined by the Erlanger Method. (Ready for publication.)

An analysis of the changes in blood pressure (as shown by the Erlanger method) during the period of going to sleep, a short nap, and the period of awakening.

### 9. Studies of Emotional Reactions. IV. Basal Metabolism.

An investigation of the changes in the basal metabolic rate concomitant with various emotional conditions of normal individuals. Work completed.

### 10. Studies of Emotional Reactions. V. Profound Emotional Upset.

An investigation of the changes in blood pressure, respiration, gastro-intestinal tone, and metabolism together with a psychological analysis (behavior study) of pronounced emotional upset in normal individuals. Work completed.

### 11. A Further Investigation of the Rating Scale Method.

An investigation of the effect of the reason given in justification of a rating, the per cent of certainty of that rating and the validity of the rating as applied to objective traits, semi-objective traits and subjective traits. Work completed.

THEOS A. LANGLEY, B.A., Teaching Fellow in Psychology.

Research under the direction of D. G. Paterson.

### 1. The Effectiveness of Intelligence Tests and Achievement Tests in English, Mathematics, and Chemistry in Prognosticating the Scholarship of Engineering Freshmen.

Analysis, largely correlational, of scholarship data and test data (involving eight hours of testing per student) for some 360 freshmen in the College of Engineering. Intercorrelations for the variables and correlations between each variable and the scholarship criterion (involving the use of simple correlation, partial correlation, and multiple correlation technique) have been computed for a group of 240 freshmen. The results are much too detailed to permit summary. In general, no system of tests and no system of weights can be made to correlate more than  $+0.61$  with freshmen engineering scholarship. This points to the urgent need of developing (a) more reliable methods of grading students and (b) methods of measuring those factors underlying scholastic achievement which are not now tapped by existent tests. However, the tests can be utilized effectively in many phases of student personnel work.

### 2. Personality Ratings of High School Seniors in Relation to Later Collegiate Success. (Part of a thesis to be offered for the Ph.D. degree.)

The attempt here is to explore the possibilities of teachers' ratings as a supplement to various prognostic tests for predicting collegiate success. Each senior is rated independently by three teachers in a uniform manner, all using a graphic rating scale consisting of eight traits or qualities. Preliminary analyses indicate the possibility of utilizing teachers' ratings as a valuable supplement to objective tests in predicting later collegiate success. This research will require two or three years for completion.

### 3. Measurements of High School Achievement As a Suitable Substitute for High School Marks. (Part of a thesis to be offered for the Ph.D. degree.)

Educational guidance work has discovered the high predictive value of school marks based on four years of high school work, but these are significant only in case the relative standings of students in large classes are available. In the case of students coming from small high schools the method is apparently not applicable. Hence, this research is designed to discover whether a high school content examination could be used as a satisfactory substitute. Such an examination including questions on English, mathematics, social science and history and general science was given to two large groups of entering freshmen, and the resulting scores correlated with high school scholarship records, college scholarship records, and with intelligence test scores. The results have not been completely analyzed but present indications are that such a content examination correlates so closely with the intelligence test scores that it will

probably fail to serve as a suitable substitute for high school marks, both the content examination and the intelligence tests failing to measure certain personality traits which seem to be very important in determining ability to get good marks in high school or college subjects.

AGNES M. THORSON, B.S., Assistant in Psychology.

The Relation of Tongue Movements to Internal Speech. *Journal of Experimental Psychology*, 8:1-32. 1925. (Thesis for the M.A. degree; K. S. Lashley, Adviser.)

A test of the theory that thinking in young children is carried out in actual movements of the vocal organs of speech, which may be suppressed later as facility in the use of language is acquired. Work still in progress.

JOSEPHINE M. BALL, B.A., Graduate Student.

The Effects of the Oestrus Cycle upon the Behavior of the Rat. (Thesis for the Ph.D. degree; K. S. Lashley, Adviser.)

A descriptive and experimental study of the behavior, general activity, and learning ability of female animals during the various phases of the sexual cycle. Combined with this is a study of the influence of diet and climatic conditions upon the age of sexual maturity and types of sexual behavior.

MARY M. SHIRLEY, M.A., Graduate Student.

The Effects of Alcohol, Strychnine, and Phosphates upon the General Activity of the Rat. (Thesis for the M.A. degree; K. S. Lashley, Adviser.)

The activity of animals under the influence of drugs of known physiological action is measured in revolving cages in an attempt to discover the basis of normal individual differences in activity. Only agents influencing general metabolism seem to have any significant influence on activity.

ALLAN CHALLMAN, Undergraduate Student.

A Study of the Numerical Ability of the Monkey. (Under the direction of K. S. Lashley.)

Animals are trained to select patterns cut from slices of fruit. The patterns are varied in size and shape while their numerical characteristics are kept constant. No evidence of ability to give generalized reactions to number has been obtained.

RALPH W. ERICKSON, B.A., Graduate Student.

The Effects of Removal of the Adrenal Glands upon the Activity and Learning Ability of the Rat. (Thesis for the Ph.D. degree; K. S. Lashley, Adviser.)

RUTH HUBBARD, M.A., Graduate Student.

Evaluation of Quantitative Methods of Measuring Interests. (Thesis for the M.A. degree; D. G. Paterson, Adviser.)

The purposes are: (1) To determine the validity of Freyd's measures of the interests of the socially inclined versus the mechanically inclined; (2) to develop a similar technique for the measurement of the interests of mechanically gifted boys at the junior high school level; and (3) to determine the influence of father's occupation on the mechanical interests and occupational choices of junior high school boys.

*Results.*—Freyd's method applied to college groups selected by vocation reveal their interests to be significantly different in a quantitative way. Those groups entering occupations that deal with people are differentiated as being more socially inclined than are those entering occupations dealing with things. Boys of junior high school



age tend to be more mechanically than socially inclined as far as these methods measure their inclinations. Furthermore, they choose occupations higher in the social-economic scale than those of their fathers and choose with little regard for their own abilities or interests along mechanical lines.

MARION MYER, B.A., Graduate Student.

Isolation and Quantitative Evaluation of Interests As an Independently Variable Factor Conditioning Scholastic Achievement. (To be offered as a thesis for the Ph.D. degree; D. G. Paterson, Adviser.)

Analyzing likes and dislikes toward a variety of life situations and activities of two contrasting scholarship groups (freshmen, native born, white, women) to obtain a scoring method based upon items toward which these two groups demonstrate a statistically significant difference. The use of this scoring method to obtain an index of scholastic interest for each of a large number of students. Computation of correlations between these scholastic interest indices and (1) actual scholarship and (2) intelligence ratings. The application of this scoring scheme in the same way as above for successive classes to determine the validity of the technique, combining the results from successive classes until a stable and valid scoring scheme emerges.

Results are tentative at present, indicating that it will be possible to isolate and measure such a non-intellectual factor as scholastic interests. Apparently it will be necessary to combine the results for several successive classes to yield an index which will be stable, dependable, and valid.

GRACE E. O'BRIEN, M.A., Graduate Student.

A Comparative Study of the Reliability and Validity of Personality Judgments As Made by Social Workers, Psychologists, and Psychiatrists. (Thesis for the M.A. degree; D. G. Paterson, Adviser.)

Original ratings and re-ratings after an interval of five months were made by the members of a child guidance clinic staff using a graphic rating scale involving thirty-seven personality traits. Each of the members of the staff rated themselves and each other on each of the thirty-seven traits. Thirteen raters were involved, seven social workers, two psychologists, and four psychiatrists. Reliability coefficients for each expert on each quality were computed and the correlation between the ratings of each expert and the composite opinion of the group were obtained. The trends disclosed hold only for the conditions under which the experiment was conducted and one could not safely generalize from these experts to the professions they are a part of. "The only real trend that comes out of this study of individual and group reliability and validity is the tendency of the judgments made by psychiatrists to be less consistent than the judgments of either psychologists or social workers." A number of other important points are analyzed in the detailed thesis of 123 pages.

GENETTE ULVIN, B.A., Graduate Student.

The Development of a Masculinity-Femininity Index and Its Relation to a Morphological Index of Sex. (To be offered as a thesis for the M.A. degree; D. G. Paterson, Adviser.)

The purpose is to determine (1) the possibility of measuring masculinity or femininity among college students as a guide to the study of inversions in interests, attitudes, etc.; (2) the relationship between such a psychological sex index and an accepted morphological index of masculinity and femininity.

The method used is an adequate sampling of freshman men and freshman women. Quantitative evaluation of an extensive questionnaire to be filled out by each subject to yield an index of sex interests. Anthropometric measurements of some subjects to yield a morphological sex index. Correlations between the two categories of measurements. Work in progress.

## ROMANCE LANGUAGES

EVERETT W. OLMSTED, Ph.D., Litt.D., Professor of Romance Languages and Head of the Department of Romance Languages.

The Story of *Aurelio and Isabella*, by Juan de Flores, published at Madrid in the forthcoming *Homenaje a Menéndez Pidal*.

The article traces the influence of this famous story of Juan de Flores upon the literatures of other countries, and presents a considerable amount of bibliographical material not heretofore assembled on this subject.

IRVILLE C. LeCOMPTE, Ph.D., Professor of Romance Languages.

A New Interpretation of a Well-Known Old French Poem.

Work in progress. Results not available at present.

COLBERT SEARLES, Ph.D., Professor of Romance Languages.

1. Seventeenth Century Comedy before Molière. To be published in *Modern Philology*.

A study designed to offset the statement that the French farce develops into the comedy of Molière "without interruption," by showing that between 1629 and 1657 there arose a type of comedy which broke with both the farce and the *comédie italienne*. This comedy which comprises nearly a hundred pieces undoubtedly exercised some influence on Molière and deserves more detailed study.

2. The *Discours à Cliton*. To be published in the *Philological Quarterly*.

Adds another name to the list of those to whom this document of the Cid quarrel has been attributed. Hypothesis based on the striking similarity of certain phrases as well as of the general point of view contained in the *Discours à Cliton* and the *Comédie des Comédiens* of Gougenot.

3. References to Contemporary Drama in Rosset's Two Collections of Stories (1619). (Submitted to *Modern Language Notes*.)

1. A discussion of an allusion to Marie Valeran, dite La Porte, one of the first professional actresses of the French stage.

2. Discussion of an allusion which implies the dramatization of current tragic happenings.

4. See also the studies by J. H. Owens, H. M. Coleman, I. G. Green, R. Guinn, G. Haley, and M. Wilson.

RUTH S. PHELPS, M.A., Associate Professor of Romance Languages.

1. Italian Silhouettes. New York: Knopf, 1924.

Literary studies, critical and biographical, of thirteen Italian writers whose work lies wholly or in part in the twentieth century.

2. The Earlier and Later Forms of Petrarch's *Canzoniere*. Chicago: University of Chicago Press. 1925.

A monograph on the date and structure of Petrarch's *Canzoniere*. The conclusion, based upon a comparative study of two manuscripts, Vat. Lat. 3195 and Chigi L.V. 176, is that the *Canzoniere* as we have it in all editions of any consequence to-day, represents two very different periods of work and two different degrees of artistic care, the earlier being the more artistically perfect. The earlier form, represented by the Chigi manuscript, consists of the first and larger moiety of Part I of the

editions, plus the first and larger moiety of Part II; this collection had been known, but never before studied as an independent whole. The work involved (1) a revaluation of all work done hitherto in dating the various poems of the *Canzoniere*, and (2) careful, tabulated studies of the arrangement according to form and content of all poems in the Chigi form, and then of all those which, when added to the Chigi manuscript, enlarged it to the form represented by V.L. 3195. A comparison of these data, as between these two groups, proves the thesis as above stated very clearly.

### 3. The Sources of Lorenzo's *Sacra Rappresentazione*.

An article which seeks to prove by means of parallel columns that the source of *La Rappresentazione di San Giovanni e Paolo*, by Lorenzo de' Medici, is to be found in a certain five of the saints' lives in the *Acta Sanctorum*; to analyze the artistic use made by Lorenzo of his sources, and to draw some conclusions as to how this material came into his hands.

EDWARD H. SIRICH, Ph.D., Associate Professor of Romance Languages.

Les Chastes et Loyales Amours de Théagène et Cariclée, Tragi-Comédie en Huit Journées par Alexandre Hardy, 1626. To be published in the *Johns Hopkins Studies in Romance Languages*.

Alexandre Hardy is the chief precursor of Corneille in the seventeenth century. He was the "fournisseur" of the Théâtre de Bourgogne, and wrote a large number of tragedies and tragi-comedies, of which about forty-five are extant. All of these have been reprinted (Stengel edition, 1884) except the tragi-comedy above named.

At Harvard University (Treasure Room) there is a copy of the edition of 1623 of the *Théagène et Cariclée*. The writer has copied this and also has photostat plates of the edition of 1626 at the Bibliothèque Nationale. It is purposed to make a definitive edition of the text, comparing the editions of 1623 and 1626 and showing, in so far as possible, the influence on Hardy of Heliodorus' Greek romance, treating the same subject.

HERBERT E. CLEFTON, M.A., Assistant Professor of Romance Languages.

The Religious Thought of Bernardin de St. Pierre. (Dissertation to be presented for the Ph.D. degree at the University of Oxford.)

JAY K. DITCHY, Ph.D., Assistant Professor of Romance Languages.

La Mer dans l'Oeuvre Littéraire de Victor Hugo. (Thesis for the Ph.D. degree, Johns Hopkins University.) To be a number of the *Johns Hopkins Studies in Romance Languages*. To be published in the *Presses Universitaires*, Paris, October, 1925.

A reasoned study of all the references to the sea in Victor Hugo, showing the influence of other writers before Hugo's direct contact with the sea, his immediate acceptance of the sea as a source of inspiration on his seeing it. The growth of this influence until Victor Hugo is completely dominated by it, improvises epics which he declaims to it, remains in constant contemplation before it, and in his testament directs that his literary fragments be published under the title *Océan* "to return to the sea that which it has given me." A hatred of the sea for its cruelty accompanies all this and the writer has demonstrated that, contrary to the accepted view, this is not due to the drowning of his daughter, Leopoldine.

ALEXANDER H. KRAPPE, Ph.D., Assistant Professor of Romance Languages.

#### 1. The Song of Grotti. *Modern Language Review*, 19:325-34. 1924.

Derivation of the Eddic song from ancient grinding ritual by the comparative method and an examination of the extant *cantilenae molares*.

2. A Flemish Legend of the Ploughman King. *Leuvensche Bijdragen* 16:93-100. 1924.

The study points out the existence of an early mediaeval Flemish variant of the ploughman king myth.

3. An Italian Legend in Pierre Damian. *Romanic Review*, 15:94-99. 1924.

Derivation of a mediaeval local legend of Southern Italy from ancient Mediterranean eschatology.

4. Note sur un Épisode de l'Historia Britonum de Nennius. *Revue Celtique*, 41:181-88. 1924.

Derivation of the episode of Vortigern's Tower from ancient foundation sacrifice offered to the snake-shaped chthonic divinities.

5. La Légende de la Maison Fermée de Toledé. *Bulletin Hispanique*, 26:305-11. 1924.

The tracing of a mediaeval Spanish legend to the ancient Mesopotamian tale of Xerxes entering the tomb of Belus.

6. Studies on the Seven Sages of Rome. *Archivum Romanicum*, 8:386-407. 1924.

Examination of the stories *Medicus*, *Aper*, and *Sapientes*. The first is derived from a Byzantine legend localized at Cps; the second is an Indian variant of the Oriental branch of the *Brave Tailor* type; the third is derived from *Geoffrey of Monmouth*. Determination of the *terminus a quo* of the compilation.

7. The Source of Novellino, XXVIII. *Neuphilologische Mitteilungen*, 26:13-18. 1925.

The source of this Italian tale must be sought in the Irish heroic legends which alone contain the main motif. The oriental hypothesis of D'Ancona and others must be discarded.

8. The Source of Pedro Antonio de Alarcón's *El Afrancesado*. *Romanic Review*, 16:54-56. 1925.

The source is an episode told by Appian in his *Civil Wars*. Two Ancient Parallels to Aucassin et Nicolette, VI. 34-40. *Philological Quarterly*, 4:180-81. 1925.

Analogues of the passage in Vergil and Seneca.

9. See also the studies by P. Archerd and R. Seeleman.

CARLOS VÁZQUEZ-ARJONA, Ph.D., Assistant Professor of Romance Languages.

Cotejo Histórico de Cinco Episodios Nacionales de Don Benito Pérez Galdos. (Thesis for the Ph.D. degree at the Johns Hopkins University.)

The purpose is to ascertain whether the writer's statements about national happenings are historical or fictitious. Each book has been studied separately, discussing each historical event in the same order in which it appears in the *Episodio*. We have used the parallel passage method, direct and indirect quotations, and very short conclusions. Material gathered at the Biblioteca Nacional, and the Ateneo de Madrid.

*Conclusion*.—With very few exceptions Galdos in these five episodes or novels, viz: *Trafalgar*, *La Corte de Carlos IV*, *Gerona*, *Zaragoza*, *Cádiz*, is primarily a historian and not a novelist.



MARGUERITE GUINOTTE, M.A., Instructor in Romance Languages.

A Critical Edition of *Sémiramis*, by Voltaire, with a Study of the Circumstances Attending Its Presentation.

The material for this study was collected during a recent trip to France.

PAUL C. KING, B.A., Instructor in Romance Languages.

Life and Literary Activities of Le Chevalier de la Morlière.

Edition with a historical commentary of an unpublished manuscript: *Anecdotes de la Cour de France sous les Règne de Charles VIII.*

OLAV K. LUNDEBERG, M.A., Instructor in Romance Languages.

1. The True Sources of Robert Godsley's *The King and the Miller of Mansfield*. *Modern Language Notes*, pages 394-97. November, 1924.

Goldoni in his memoirs attributes the source of Godsley's play to Calderon who employed a somewhat similar motif in his *Alcalde de Zalamea*. Comparison of the plots shows only slight similitudes and Goldoni's attribution seems gratuitous. Godsley undoubtedly based his play on a ballad, *The King and the Miller of Mansfield*, first published in 1624. Furthermore, the love motif of the play was suggested by certain tales from Painter's *Palace of Pleasure*, published in 1566, which Godsley certainly had read.

2. Collé's Borrowing from the *Sully Memoirs*. *Modern Language Notes*, June, 1925.

Points out to what extent Collé drew on the *Sully Memoirs* for documentation of his play, *La Partie de Chasse de Henri IV.* By reference to the memoirs it is established that the events recorded in the play took place in May, 1605. The textual similitudes are striking, in many cases verbatim, and reveal Collé as a student of the historical documents of his country.

3. Ibsen in France: a study of the introduction, influence, and vogue of the Ibsen drama in France. *Scandinavian Studies and Notes*, pages 93-108. November, 1924.

A study of the reception accorded to Ibsen's ideas by the French critics. Discussion of Lemaitre's charge that Ibsen was inspired by George Sand's social doctrines, wherein it is proved that Ibsen denied having ever read Sand, and that his teacher in the matter of woman's status was rather the Norwegian authoress, Camilla Collett. Discussion of objections to Ibsen's technique by Sarcey and other Scribe adherents. Brief review of Ibsenists among younger French dramatists, Curel, Donnay, Brieux, Maeterlinck. Table of French translations of Ibsen's works to date. Table of Ibsen premières on French stage.

4. Life and Works of Charles Collé (1709-1783), Chansonnier, Dramatist, and Author of *Memoirs*. (Thesis in preparation for the Ph.D. degree.)

Collé known chiefly as the author of *La Partie de Chasse de Henri IV*, historical comedy in eulogy of the "Good King," enjoyed popular esteem as author of *Parades*; and, as dramatic purveyor to the Duc d'Orleans, attained success with his Théâtre de Société. His *Journal* is an important source of information about eighteenth century authors and plays.

ELIZABETH NISSEN, M.A., Instructor in Romance Languages.

Guiot de Dijon.

A critical edition of the poems attributed to Guiot de Dijon with comments on their authenticity and on the identity of the personages mentioned. Nearly ready for publication.

ARTURO TORRES-RIOSECO,\*B.A., Instructor in Romance Languages.

1. Eduardo Barrios, a Chilean Novelist. Critical appreciation. *Hispania*, May, 1925.

2. Florencio Sánchez, Argentine Dramatist. To be published in *Hispania*.

3. Main Currents of Chilean Literature. Criticism and bibliography. (Submitted for publication.)

4. Longfellow and Spain.

An article dealing with Longfellow's trip to Spain and his literary essays about the country.

5. Rubén Darío. Doctoral Dissertation.

6. The Influence of Góngora on Contemporary Spanish Poets.

7. The Women of the Romantic Dramas of Spain. A study.

GEORGE B. WATTS, B.A., Instructor in Romance Languages.

1. The Life, Literary Quarrels, and Works of François Gacon. (Thesis to be offered for the Ph.D. degree.)

There being no study of this early eighteenth century poet and satirist, an attempt has been made to put into cohesive form the widely scattered material drawn from literary historians, Gacon's printed and unprinted works, police and civil records, and other sources. Involved with many of the leading literary figures of the age, he played a part in many of the bitter poetic disputes of his day. A considerable number of unpublished poems which occur among the manuscripts of Lyons, Aix-en-Provence, and Paris, are included for printing.

2. Notes on Voltaire. *Modern Language Notes*, 39:479-82.

1. Voltaire's Correspondence with M. DeBrus. A hitherto unpublished letter from Voltaire to DeBrus casts additional light on the famous Calas affair.

2. Possible variants of *Oedipe*. The *Journal Satirique-Intercepté* contains several variants of *Oedipe* which have been quite overlooked.

3. Voltaire's Correspondence with Bollioud Mermet. An interesting letter from the secretary of the Academy of Lyons illumines an obscure letter of Voltaire.

3. The Authorship of Two Pamphlets against La Motte's *Inès de Castro*. *Modern Language Notes*, 40:32-35.

A publication of 1723 indicates that *Le Sentiment d'un Spectateur français*, which has been ascribed to Voltaire, Marivaux, and many others, was from the pen of Voltaire's factotum, Thieriot. The same publication attributes *Les Antiparadoxes* to the Abbé Desfontaines.

4. The Authorship of *l'Elève de Terpsicore*. *Modern Language Notes*, 40:125.

A passage from a forgotten pamphlet establishes the fact that this work was known to be by Louis de Boissy in 1719, immediately after its appearance. Other ascriptions to de Boissy are all considerably later.

5. Voltaire's Verses against Louis Racine's *De la Grâce*. *Modern Language Notes*, 40:189-90.

The publication of Voltaire's well-known epigram early in 1722 reveals the fact that it was written and published considerably earlier than has been believed. There are several variants in this hitherto unnoticed form of the poem.

## 6. Was Dancourt a Plagiarist? (In press.)

A satirical poem published in 1696 accuses Dancourt of generous borrowings from his contemporaries. This statement strengthens the belief (expressed by some historians and denied by others) that some of Dancourt's best comedies were not wholly his own invention.

7. Notes on Voltaire: I. Lettre écrite à M. le Comte de \* \* \* au Sujet de *Mahomet*. (In press.)

This defense of Voltaire's *Mahomet* seems to be by the Abbé Aunillon, it occurring among a collection of works ascribed to him in a manuscript of the Arsenal. Furthermore, an unpublished letter by Voltaire, from the same manuscript, strengthens this ascription, and throws additional light on Voltaire's relationships with Aunillon. II. The date of Voltaire's return in 1742 from Brussels to Paris. The letter published in I fixes the date of Voltaire's return to Paris and shows that there is considerable confusion in the order of some of the letters published in the Moland edition of Voltaire's *Oeuvres*. III. An unpublished Calotte d'Arrouet. An amusing Brevet de la Calotte from an eighteenth century manuscript jeers at Voltaire's first works and reveals his induction into the famous Régiment des Fous at an early date.

8. Minutoli's *Dépêches du Parnasse, ou la Gazette des Savants*. (In preparation.)

Literary historians have signalled the existence of this short-lived periodical, but nothing definite seems to have been known about it. Printed in Switzerland, it was copied in Lyons, accordingly Minutoli abandoned the venture. An unpublished manuscript gives a very complete idea of this publication, showing it to have taken a part in the famous Quarrel of the Ancients and the Moderns. It contained many of the verses of the day which have several variants from the standard versions. It has a poem which has been ascribed to Racine, strengthening this ascription.

JOHN H. OWENS, M.A., Instructor in Romance Languages.

## The Répertoire of Molière, a Study Based upon the Registre of La Grange. (Thesis for the M.A. degree; Colbert Searles, Adviser.)

The purpose was to secure the necessary data for a further treatment of the répertoire in its influence upon the work of Molière. An attempt was made to view in a financial way the pieces which Molière produced, and thus to ascertain the sources, the relative successes, and the genres of his productions, as well as a few statistics upon general theatrical conditions of that time. The work is divided into two parts. In the first, the various pieces are treated individually with respect to origin, genre, length, total performance, daily and total receipts, theater averages, etc. The second part deals with comparative statistics under the following titles: classifications according to total productions, total receipts, and theater average receipts; classifications of premières according to receipts, years, months, and days of the week; analysis of representations by months and by years; and comparative statistics yearly, monthly, and daily. There are three appendices concerning the currency of the period, the incorrect dates in the *Registre*, and a production of the "cash-sheet" of the première of the *Malade Imaginaire*.

H. PAUL ARCHERD, B.A., Graduate Student.

## The Dioscures in Spanish Saints' Legends. (Thesis to be offered for the M.A. degree; A. H. Krappe, Adviser.)

The work purports to prove the survival of ancient twin legends in mediaeval hagiology.

HELEN M. COLEMAN, B.S., Graduate Student.

*Le Railleux* of Maréchal and the *Misanthrope* of Molière. (Thesis to be offered for the M.A. degree; Colbert Searles, Adviser.)

The same theme treated by two poets within an interval of thirty years (1638 and 1666). A study of the differences rather than the similarities.

ISABEL G. GREEN, B.A., Graduate Student.

Theory of the Comedy to the Time of Molière in France. (Thesis to be offered for the M.A. degree; Colbert Searles, Adviser.)

ROBERT GUINN, M.A., Graduate Student.

Bibliography of Seventeenth Century Comedy Prior to Molière. (Thesis for the M.A. degree; Colbert Searles, Adviser.)

Contains a discussion of contested dates.

GERALDINE HALEY, M.A., Graduate Student.

Historical Commentary on the Flomire Hypondre of Le Boulanger de Chalussay. (Thesis for the M.A. degree; Colbert Searles, Adviser.)

A violent dramatic satire against Molière by an obscure writer apparently well informed about the poet's life.

ROSA SEELEMAN, M.A., Graduate Student.

A Study of the Novelas Exemplares of Cervantes. (Thesis for the M.A. degree; A. H. Krappe, Adviser.)

MARION WILSON, B.S., Graduate Student.

Historical Commentary on Grimarest's *Vie de Molière* (1705). (Thesis to be offered for the M.A. degree; Colbert Searles, Adviser.)

## SOCIOLOGY

F. STUART CHAPIN, Ph.D., Professor of Sociology and Chairman of the Sociology Department.

### I. A Dependency Index for Minneapolis.

A research project, nearly completed, as carried on by graduate students under the direction of F. S. Chapin. This study consists in the application of the technique of time analysis to five statistical series, embodying in general the ten-year period ending December, 1924, with data given by months. The following graduate students and teachers in the department have each prepared original data and worked on the series indicated.

Dorothy P. Gary—Bank Clearings and Debits.

Jessie Ravitch—Total Case Load for Two Single Series—University Dispensary and Minneapolis Visiting Nurse Association.

H. C. Mohler—Cases under the Municipal Lodging House, Minneapolis.

Helen Kittredge—Total Case Load for Family Welfare Association, Minneapolis.

J. F. Markey—Total Cases, Minneapolis Public Poor Relief Department.

Correlations of —.52 for a six months lag have been found with Snyder's *Index of Bank Clearings and Debits*, and the *Minneapolis Family Welfare Index*. The problem embraces new methods in the analysis of time series with marked seasonality, and may have practical value for prediction as correlation coefficients prove significant.



2. The Statistical Definition of a Societal Variable. *American Journal of Sociology*, 30:154-71.

One of the basic problems for the sociologist is the discovery and definition of his constants and the description of his variables. This paper seeks to use the statistical method in defining the societal variable—room overcrowding among families of Chicago workers. The coefficient of correlation, mean, standard deviation, and standard error are computed for ten Chicago groups. It is concluded that there is less variation among the means of the samples than in any series of observations in a single sample. Standard errors of means of samples confirm this conclusion. These findings establish a strong mathematical probability that the original samples were well chosen, although the reports of field work do not in themselves establish this point to the satisfaction of critical statisticians. The statistical analysis made in this paper suggests a way in which it is possible to check back upon original field work investigations and is an example of the practical value of applying refined statistical methods in sociology.

3. See also the studies by C. R. Hoffer and G. A. Lundberg.

PITIRIM A. SOROKIN, Dr.Soc., Professor of Sociology.

1. L'Etat Actuel de la Russie. Torino: Bibliothèque Sociologique de "Vox Populorum." 1924. 90 pages.

2. Sistema Sociologii (System of Sociology), 2d ed., Vol. I, Part I. Prague. 1924. 120 pages.

3. The Sociology of Revolution. Philadelphia and London: Lippincott Co. 1925. 428 pages.

4. Leaves from a Russian Diary. New York: Dutton Co. 1924. 310 pages.

5. Ideologia Agrarisma. (Ideology of Agrarian Movement) Prague: Khutor Co. 1924. 35 pages.

6. The same in Bulgarian edition. Sophia. 1924.

7. New Soviet Codes and Soviet Justice. *Michigan Law Review*, 23:1. 1924.

8. American Millionaires and Multimillionaires, *Journal of Social Forces*, 3:627-40. 1925.

9. Influence of the War on Divorce-Movement. To be published in the *Journal of Applied Sociology*, September, 1925.

10. *Social Mobility and Social Cycles*.

A study in social dynamics. Methods used: statistical, historical, and biographical. Work in progress. The greater part of the material is collected; some chapters are roughly outlined.

11. See also the studies by C. C. Zimmerman and V. R. Kennedy.

MANUEL C. ELMER, Ph.D., Associate Professor of Sociology.

1. The Evaluation and Scoring of Community Activities. (Preliminary report.) *American Journal of Sociology*, 30:172-77.

The evaluation of communities and the scoring of social activities must be made along three general lines: first, the community in general in its relation to the activity concerned; second, the specific activity with regard to its program, equipment, and participants; and third, an analysis of the activity in terms of its *functioning*. The last has been largely neglected in certain types of investigation, because of the difficulty

in establishing an objective unit of measure for the functioning of group activities. Functioning can be measured objectively in terms of what it accomplishes. The above principles have been made the basis for developing sets of objective tests and measures of social activities which are apparently proving to be reliable, but which are still being tested further as measures of the functioning of social activities.

2. Women in Industry in St. Paul, Minnesota. Published by The St. Paul Association of Business and Public Affairs. 1925. 48 pages.

A study of the participation of women in the industry of a city and the effect of various factors such as age, marital condition, nationality, race, and training have upon the opportunity for the success and advancement of women in different types of work. The great fluctuation due to seasonal employment falls particularly heavy upon women because of the belief that to be out of work will work less hardship upon them than men. The fluctuation varied from 8.695 to 17.260 in a two-year period. The study showed that a high per cent (24 per cent) of all women were married, also that there was a strong preference for married women in over one third of the establishments. A noteworthy situation was shown by the fact that there was a labor turnover of employed women of 44 per cent per year, and also that nearly one half had no previous training for their present work.

3. Secretarial and Office Positions for Women. To be published by the Woman's Occupational Bureau, Minneapolis, July, 1925.

The results of this study are based on the analysis of the data from establishments employing over 5,000 women in office positions, and personal interviews with 500 employed women. It deals primarily with the classification of office positions and the distribution of women employees in various lines according to age, experience, training, length of service, and wage groupings. The study should serve as a basis for advising women concerning opportunities and requirements for success in different phases of secretarial and office positions.

4. Statistical Methods Applied to Sociology. To be published in the summer of 1925.

A book dealing with the special problems which arise in the study of social phenomena, and the use of statistical methods in the analysis of social conditions and activities.

MILDRED D. MUDGETT, Ph.D., Assistant Professor of Sociology.

#### 1. Wherein Has the Juvenile Court Failed?

The object of the study is to discover through personal interviews with the girls at Sauk Center and the boys at Red Wing who have had juvenile court experience where the court has failed. What were the benefits derived from periods of probation and from commitments to the county home schools as well as the failure of these methods of treatment. The collection of the data is by Elsa Castendyck, a student under the author's supervision.

#### 2. (With Elsa Castendyck.) County Allowances in Minnesota.

A book on mothers' pensions, to be ready for publication June, 1925.

3. Case Work Problems with Special Reference to Relationships between Parents and Children. *Proceedings of the National Conference of Social Work, 51st session, 1924.* Pages 280-84.

4. Results of Minnesota's Laws for the Protection of Children Born Out of Wedlock. Washington, D.C. *Federal Children's Bureau Publications*, No. 128, 1924. 56 pages. (Thesis for the Ph.D. degree.)

C. RUSSELL HOFFER, Ph.D., Instructor in Sociology.

Commodity Distribution in Rural Communities As a Form of Community Service. (Thesis for the Ph.D. degree; F. S. Chapin, Adviser.) Abstract in the *Proceedings of the American Sociological Society* for 1924.

The purpose of this study was to study the social and economic relations of town and country. It was based on a survey of twenty-three stores in twelve rural trade centers in Minnesota.

HAROLD A. PHELPS, Ph.D., Instructor in Sociology.

Social and Economic Factors Influencing the Organizability of Labor. (Thesis for the Ph.D. degree; A. H. Hansen, Adviser.)

This investigation, consisting of fifteen chapters, is based on a comparative study of the history of unionism in Rhode Island and Minnesota. It is impossible to summarize satisfactorily the contents of the work, within the limitations of the space available. The final conclusion of this investigation is that the organizability of the industrially employed is a function of conditions created by the nature of the work, and that these conditions, (1) skilled labor or its equivalent, (2) limited labor market, and (3) closed wage group, correspond closely with the trends of unionism.

CARLE C. ZIMMERMAN, M.S., Instructor in Sociology.

(With P. A. Sorokin.) Rural vs. Urban Demography.

The purpose is to find the differences between urban and rural populations and analyze these differences for causes. A comparative analysis of urban and rural populations was made according to birth rates, death rates, sickness, existence of feeble-minded, insane, socially unfit, geniuses, morality, migrations, and other social vital and demographic processes. The sources are the statistical publications of the governments of the world dealing with vital and demographic processes for the two populations and also the files of the leading scientific journals in each country. Results and conclusions so far are merely tentative. Work in progress.

VALERIE R. KENNEDY, B.A., Graduate Student.

The Vital and Social Statistics of Members of Congress and Officers of the Federal Government. (Thesis for the M.A. degree; P. A. Sorokin, Adviser.)

GEORGE A. LUNDBERG, Ph.D., Graduate Student.

Poor Relief Legislation in Minnesota. (Thesis for the Ph.D. degree; F. S. Chapin, Adviser.)

# THE COLLEGE OF ENGINEERING AND ARCHITECTURE

## CIVIL ENGINEERING

FRED C. LANG, C.E., Associate Professor of Highway Engineering.

### 1. Investigation of Vibrolithic Concrete.

The study included a comparison with concrete from pavements constructed by ordinary methods. An experimental pavement was constructed in sections varying from 150 to 350 feet in length, and on these various sections different proportions of aggregate were used and also three different kinds of aggregate. One section of this pavement was constructed without reinforcement and one section without expansion joints. Cores will be taken from this pavement next year to determine the properties of the different kinds of concrete, also to compare the value of the vibrolithic method of construction with the Lakewood tamper and hand tamping methods. The pavement will be observed from time to time and careful note made of all outstanding features.

### 2. Investigation of Sheet Asphalt and Topeka Pavements.

Comparison of Topeka asphaltic concrete surface with various types of sheet asphalt pavement under traffic. An experimental pavement 600 feet long was constructed as follows, on the same base and using the same binder as that used for a Topeka asphaltic concrete surface which adjoins it: (1) 200 feet using limestone dust as mineral filler and 18 per cent bitumen; (2) 200 feet using portland cement as mineral filler and using a slight increase in bitumen; (3) 200 feet constructed according to regular sheet asphalt specification, using limestone dust as mineral filler.

### 3. Suitability of Certain Limestones and Sandstones of the State for Use in Concrete Pavements.

To determine whether some of the rocks found and quarried in the state which fail to meet some of the present requirements of the Minnesota Highway Department but which may in many cases be produced and delivered to the job at a lower price than some of the better rocks, should be used in concrete pavements. Concrete cylinders (6x12) were made up of Fowler and Pay limestone, Minnesota Crushed Stone Company limestone, Kettle River sandstone, and Dresser Junction trap using a 1:2:4 mixture. One third of these cylinders were subjected to a condition of alternate freezing and thawing, one third were given ideal laboratory conditions. These cylinders will be broken at the age of six months. The other one third have been placed out in the open where they will be exposed to varying weather conditions. These cylinders will be broken at the age of one year.

### 4. Effect of Shale Pebbles in Concrete and Removal of Shale from Gravel.

To determine the effect of shale pebbles on concrete's compressive strength and to devise laboratory and commercial methods of removing shale from gravel. A number of tests have been made on concrete containing different amounts of shale and subjected to alternate freezing and thawing conditions. Methods of separating shale from pebbles have been investigated.



## DRAWING AND DESCRIPTIVE GEOMETRY

ORRIN W. POTTER, E.M., Instructor in Drawing and Descriptive Geometry.

The Effects of Heat Treatment on the Properties and Micro-Structures of Grey Cast Iron and Semi-Steel. (See abstract listed under the School of Mines.)

LLOYD J. QUAD, B.S.(E.E.), Instructor in Drawing and Descriptive Geometry.

The Phenomena of Fluid Flow in the Wake of Objects Moving in a Fluid.

The wake of an object that is not especially streamlined in a region of irregular, churned, and eddying fluid flow. The purpose of this problem is to attempt, in the cases of a few objects of fundamental geometric shapes, to discover some regularity or law of flow. A small water tunnel was used. The tunnel had glass sides and colored silk threads suspended in the stream showed the lines of flow. Various velocities of flow were used. The objects or specimens studied were the plane, the rectangular block, the cylinder, and the sphere. The specimens were suspended in such a way that they could be spun on various axes and the forces exerted by the stream on the objects could be measured. Work unfinished.

## ELECTRICAL ENGINEERING

GEORGE D. SHEPARDSON, M.A., M.E., D.Sc., Professor of Electrical Engineering and Head of the Department of Electrical Engineering.

1. The Distinction between Electrical and Electric.

This is a linguistic study to determine a consistent basis for differentiating between the two adjectives. The two are used indiscriminately by many writers. No principle of euphemy seems to govern the choice. An examination of common practice develops that the shorter form is more generally associated with the practical utilization of electricity, while the longer form is more generally associated with people and with ideas that suggest theory. Checking this distinction, it is found that of the 85 words almost always used with "electric" the rule holds for all except two; of the 120 words almost always associated with "electrical," all except eight, or possibly twelve, are predominantly associated with people or theory. Closely similar proportions hold for the words with which both forms are used, including fifteen words with which "electric" is more commonly used, and eleven with which "electrical" has the greater preference. While the distinction indicated is not clear in every case, it is believed to prove a reasonably definite guide for practice, and is recommended.

2. (With Hugo Hanft and Harold D. Smith.) Electric Timing System.

Portable mechanism has been constructed for giving signals at intervals of one, five, and ten seconds for athletic pacing. Progress is being made on a precise method for timing athletic events.

3. See also the studies of W. F. Kannenberg and C. S. Sampson, L. J. Schnell, and R. W. Keller.

RENE A. BRADEN, B.S.(E.E.), M.S., Teaching Fellow in Electrical Engineering.

1. The Amplitude of Forced Vibrations in Vacuum Tube Circuits. (Thesis for the M.S. degree; under the direction of C. M. Jansky, Jr.)

It is shown that a complete study of regeneration in a radio circuit must include regeneration in an amplifier as well as in a detector. Two adjustments of the feedback coupling are found to give maximum response to an impressed voltage, one being due to regeneration, the other being due to oscillation hysteresis. Experimental verification of a simple explanation for the latter is secured.

The effects of resistance in the tuned circuit of a regenerative system are studied, and the difference between the effects of regeneration in a detector and of regeneration in an amplifier is emphasized. It is shown that the best adjustment of the tickler coil in a regenerative detector may be such that the circuit generates free oscillations, and that in such a case the best adjustment of regeneration varies with the impressed voltage. A number of other effects are studied also, such as variation of grid bias battery, effect of removing resistance from coil and adding to tuning condenser, effect of using grid leak and condenser instead of a grid battery, and variation of amplitude of forced oscillation with resistance in the tuned circuit. The second current maximum, to which the name pseudo-regeneration is given because of its superficial resemblance to regeneration, is found to be related to oscillation hysteresis.

## 2. Audio-Frequency Amplifying Transformer Tests. (Under the direction of C. M. Jansky, Jr.)

The transformation ratio (the ratio of the voltage across the terminals of the secondary winding to the voltage impressed on the primary winding plus the equivalent resistance of plate-filament space) is definite only when considered in connection with the particular vacuum-tube with which it is used. Two methods of determining the transformation ratio are discussed and are used. Curves show the relations between the frequency and the voltage ratio of a number of commercial types of audio-frequency transformers. Other curves show the effect of frequency on the loudness of sound from a typical loud-speaker when used with the various transformers. In connection with this study, a mathematical theory is developed for the amplifying transformer.

A supplementary report on the design and construction of a tuned audio amplifying transformer, and comparative tests of this and of commercial transformers is abstracted in *QST*, 9:43-44. 1925.

## 3. Development of Methods for Testing the Frequency Characteristics of Audio Frequency Transformers.

The development of the method has been completed and frequency characteristic curves of a large number of commercial transformers have been obtained. Article is now in the process of preparation for publication.

OTTO F. B. HEIDELBERGER, B.S. (E.E.), M.S., Teaching Fellow in Electrical Engineering.

Measurements of Induction Coil Voltage Peaks, with Special Reference to Ignition. (Thesis for the M.S. degree; F. W. Springer, Adviser.)

Quantitative investigations of the spark used for ignition in gas engines have heretofore been limited to measurements of the total energy, no practicable method having yet been developed for separating the electrostatic from the electromagnetic components, nor for determining the peak voltage at the instant of discharge. The usual methods of measuring peak voltage are not applicable, because the amount of capacity and of energy required for the measuring instruments is usually greater than the entire quantities involved in the spark gap. Use of a calibrated auxiliary sphere-gap with one fourth inch spheres was found to give consistent results without appreciably disturbing the spark-gap circuit.

A second method of measuring the impulse voltage was developed, based on applying a negative bias to the grid of a vacuum tube to reduce the plate current to zero, the calibration showing a nearly straight line from 8,000 volts at 0.025 inch separation of the spheres to 16,400 volts at 0.25 inch.

WALTER F. KANNENBERG, B.S.(E.E.), M.S., Graduate Student.

1. Studies in Television. (Thesis for the M.S. degree; under the direction of G. D. Shepardson.)

Investigation of methods developed for transmitting pictures and of certain problems encountered in speeding up these or allied processes to secure television. While the time required for actual transmission of a single picture over a telephone or equivalent circuit is about seven minutes, television requires a speeding up to more than ten pictures per second. This thesis includes bibliographic studies of the development of light sensitive cells, of schemes for picture transmission, of efforts toward the attainment of television; an analysis of the problems involved in television; bibliographic and experimental study of methods of synchronizing the sending and receiving mechanisms; experimental studies of speed of response of photo-electric cells for transmission and of lamps for reception.

2. Oscillographic Study of Transient Effects in Radio Telegraph Transmitters Caused by Keying. (Under the direction of C. M. Jansky, Jr.)

This is a quantitative oscillographic study of methods proposed in an editorial discussion by S. Kruse in *QST* of July, 1923, for mitigating the disturbances to radio listeners when an operator in the vicinity is sending telegraphic messages by radio. After developing special equipment for reproducing dot and dash signals under controllable conditions, visual and photographic records of the telegraphic current were made with various combinations of resistance, capacitance, and inductance in the sending circuit. The oscillographic records confirm the original reports. Analysis shows that by the use of a proper electric filter in the key circuit, radio telegraphic signals may be given wave-forms without excessively steep growth or decay, such giving minimum disturbance to neighboring circuits.

CLIFFORD S. SAMPSON, B.S.(E.E.), M.S., Teaching Fellow in Electrical Engineering.

Distribution, Measurement, and Calculation of Magnetic Flux about Bus-Bars. (Thesis for the M.S. degree; under the direction of G. D. Shepardson and F. W. Springer.)

Problems relating to the distribution of magnetic field about large rectangular or sheet conductors carrying heavy currents. Mathematical and experimental proof that the fields are ellipses, if not affected by external forces. The assumption that there would be no magnetic leakage through a solenoid composed of a sheet instead of helically wound conductors is disproved. The mathematical analysis of the field strength, and the development of the flux-meter, pave the way for further investigations of the forces that are liable to act in cases of extraordinarily large currents. An ingenious and successful instrument, the flux-meter, was devised for measuring the strength of the field across any limited area, consisting essentially of a pivoted coil in a non-magnetic frame with hair-spring control.

LOUIS J. SCHNELL, B.S.(E.E.), Teaching Fellow in Electrical Engineering.

1. Visual Stationary Electric Waves of Ultra-high Frequency. (Under the supervision of F. W. Springer and G. D. Shepardson.)

The reconstruction of a Tesla coil was completed, this giving without apparent distress an energetic discharge across a 52-inch needle gap with fundamental frequency of approximately 135,000 cycles per second with a logarithmic decrement of 0.267. In addition to the usual phenomena observed with Tesla coils, this one shows standing and apparently spiral waves apparent to the eye and recorded photographically by time exposures. These are possibly harmonics with an apparent wave length of approximately 2.75 centimeters, corresponding to a computed frequency of approximately 11,000.

000,000 cycles per second. This seems to be the first known case of standing electric waves being directly visible to the eye. Further study may determine whether the frequency has actually the unprecedentedly high value indicated.

## 2. Studies of High-Frequency Electromagnetic Radiation. (Under the direction of C. M. Jansky, Jr.)

Using a 50-watt vacuum-tube oscillator transmitter radiating 12-meter waves from a movable radiating system, the field strength is being measured under various conditions. Effects of various sources of reflection are being studied, as well as directional radiation from the antenna. Work in progress.

VAN M. COUSINS, Undergraduate Student.

## Design and Calibration of Wavemeter. (Under the direction of C. M. Jansky, Jr.)

After a general study of the sources of error and of loss, a wavemeter for 35 to 45 meters and for 70 to 90 meters was constructed. This was then calibrated by means of standing waves on a pair of parallel conductors.

RAYMOND W. KELLER, Undergraduate Student.

## The Application of Art to Artificial Lighting. (Under the direction of G. D. Shepardson.)

A bibliographic study.

# MATHEMATICS AND MECHANICS

JACOB O. JONES, M.C.E., Associate Professor of Hydraulics.

## Loss of Energy of Flowing Liquids in Gradually Expanding Tubes.

The purpose of this investigation is to determine loss of head in Venturi meters, draft tubes, and similar appliances. The method is by direct measurement. Equipment is being assembled for this study.

HENRY E. HARTIG, Ph.D., Assistant Professor of Mathematics and Mechanics.

## The Apparent Transmission of Low Voltage Velocity Electrons through Aluminum Foil. (See abstract under Department of Physics.)

GEORGE C. PRIESTER, B.E., M.S., Assistant Professor of Mathematics and Mechanics.

## 1. Determination of Poisson's Ratio. *Minnesota Techno-log*, Volume 5, No. 8, 1925.

The purpose is to discuss the various methods used to determine Poisson's ratio and to determine this property by means of the elastic relations existing between the modulus of elasticity and the modulus of rigidity. Poisson's ratio was determined for the following metals: mild steel, cast iron, semi-steel, cast aluminum, rolled duralumin, and rolled aluminum. The method used gave results in good agreement with those of other investigators using the same and other methods where the same materials were used. The values found for the other materials were within the possible range, which is between zero and one half. The values of cast metals appears to be near one third, while rolled metals have values ranging from one fourth to four tenths.

## 2. The Effect of Temperature on the Physical Properties of Steel.

To determine the effect of temperature on the ultimate strength and other physical properties of steel having different carbon content and subjected to standard heat



treatment. In performing these tests the specimens are first prepared and given the proper heat treatment and then maintained at the desired temperature while the tensile tests are being made. The temperature is maintained by a specially designed electrically heated furnace, which incloses the specimens during the test. An extensometer is also attached to the specimen. The results and observations on 0.16 per cent carbon steel have been published in *Chemical and Metallurgical Engineering*, January 17, 1923. Tests are practically completed.

H. LYLE SMITH, M.S., Instructor in Mathematics and Mechanics.

1. On the Existence of the Stieltjes Integral. *Transactions of the American Mathematical Society*, 27, No. 4:491-515. October, 1925.

A pair of conditions necessary and sufficient for the existence of the Stieltjes integral from  $a$  to  $b$  of  $\psi(t)d\phi(t)$  are derived for the general case where  $\phi(t)$ ,  $\psi(t)$  are neither assumed to be of limited variation. The results are obtained by a combination of geometric and analytic methods. A corollary is that if the line integral of  $ydx$  exists for a simple closed (continuous) curve  $c$ , then  $c$  is squarable. Two crinkly curves are constructed, one of which shows that the converse of this corollary is not true.

2. Some Notes on Cauchy-Ampere Derived Functions. *Annals of Mathematics*. Second Series. 27, No. 2:69-72. December, 1925.

A mean value theorem expressing the Cauchy-Ampere derived function of order  $n$  in terms of the function of order  $(n-1)$  is derived and used to find certain theorems on bounded Cauchy-Ampere derived functions.

3. On Functions of Closest Approximation. Read before the American Mathematical Society, Chicago, April 11, 1925; to be submitted to the *American Journal of Mathematics*.

Certain results of D. Jackson concerning the minimizing of the integral from  $a$  to  $b$  of  $|f(x) - [c_1\phi_1(x) + \dots + c_n\phi_n(x)]|^m dx$  ( $m > 1$ ) are extended to the case of the integral from  $a$  to  $b$  of  $|f(x) - [c_1\phi_1(x) + \dots + c_n\phi_n(x)]|^m |du(x)|$  where  $u(x)$  is a function of limited variation. These results are then applied to the study of the minimizing of finite sums of analogous form. This work was undertaken at the suggestion of Professor D. Jackson.

4. Further Study of the Stieltjes Integral. (Dissertation for the Ph.D. degree at the University of Chicago.)

A mean value theorem is derived for the Stieltjes integral from  $a$  to  $b$  of  $\psi(t)d\phi(t)$  for an important case when  $\phi(t)/\psi(t)$  are not assumed to be of limited variation. It is hoped to find proofs of Green's lemma and similar theorems under lighter hypotheses than are usually used.

5. On the Foundations of the Differential Geometry of Skew Curves. (Preliminary report.)

The fundamental notions of tangent, osculating plane, osculating circle, curvature, and length of arc are studied as to their independence and dependence. A curve is constructed which has a tangent at a certain point  $P$  but which is such that no matter how the parametric representative of the curve is chosen, the slope of the tangent at  $P$  can not be expressed in terms of the (first) derivatives of the co-ordinates with respect to the parameter. An extension of the notion of derivative is introduced to overcome this difficulty. The theory of skew curves in terms of these derivatives is being made.

## MECHANICAL ENGINEERING

FRANK B. ROWLEY, B.S., M.E., Professor of Mechanical Engineering.

1. Insulating Value of Air Spaces in Building Materials with Special Reference to Double Glass Windows.

The purpose of this work is to determine the best spacing for double glass windows to prevent the transfer of heat and also to determine the best size of air spaces of insulating walls. This work is being done with a specially designed hot box in conjunction with a cold storage room. The double glass or walls to be tested and subjected to a temperature of 80° on one side and approximately 20° below zero on the other side. The heat passing through the surface under these conditions is supplied by electric heaters and measured by meters. The cold temperatures are maintained with a seven and one-half ton ammonia compression refrigerating machine. Work unfinished.

2. Burning of Fine Grades of Coal in Domestic Heating Plants.

The purpose of these tests is to determine to what extent the combustion of fine grades of anthracite coals can be improved by the use of artificial draft under the grates. In the tests a No. 25 Capital Winchester boiler is being used. The draft under the grates is created by a centrifugal blower capable of producing pressures up to four inches of water. The present series will include the anthracite coals of both buckwheat and rice sizes. Work in progress.

BURTON J. ROBERTSON, E.E., Assistant Professor of Mechanical Engineering.

Effect of Atmospheric Conditions and Temperature on Performance of a Gasoline Motor.

The purpose of this work is to determine (a) the fuel consumption, starting characteristics, etc., of a motor operated in winter atmosphere, with gasolines having different distillation curves; (b) the effect of cold weather upon crank case dilution.

The motor is mounted on a platform out of doors with the dynamometer and control in the laboratory. The usual complete running tests will be made upon the motor during the colder winter days. Several different grades of fuel will be used under the same running conditions. Distillation curves will be determined for each fuel used and the fuel consumption, horse power, and efficiency of the motor referred to the distillation characteristic of the various fuels. Further investigation will be made of the effect of temperature of the atmosphere upon crank dilution. Work unfinished.

THOMAS P. HUGHES, Instructor in Forge Practice.

1. The Strength of Welds and Some Contributing Factors. Preliminary report published in the *Minnesota Techno-log*, March, 1925; and reprinted in the *Journal of Blacksmiths and Dropforgers*, Chicago.

The purpose of the research was to determine the comparative value in tensile strength and ductility of welded bars and unwelded ones. Material used was soft steel, hot finished, and the tests were made on a Riehle tension-testing machine. Conclusions reached so far as the investigations have gone indicate that under certain conditions a welded bar may be made equal in both tensile strength and ductility to an unwelded bar.

2. Quenching and Quenching Media.

The purpose of the investigation was to determine the relative quenching rate of several media and consequent hardness on steel of definite and known analysis quenched

from a uniform definite and known temperature. Material used was a 0.65 per cent straight carbon steel. Specimens were 1" long 1" diameter circular bars. They were heated in an electric furnace. Temperature control was by aid of platinum-rhodium thermo-couple attached to potentiometer. Media used: water varying temperatures, sulphuric acid, glycerine and glycerine-water solutions, valve oil at varying temperatures, quenching oil at 45° C., brine at 0° C., water spray under pressure. Work unfinished.

FRANK MORRIS, B.S., Graduate Student.

The Effect of Auxiliary Air on Smokeless Combustion of Bituminous Coal in a Domestic Heater. (Thesis for the M.S. degree; F. B. Rowley, Adviser.)

The purpose of this series of tests was to determine the best percentage of secondary or auxiliary air to be used in the burning of bituminous coals, the primary object being to secure smokeless combustion. In the tests a Utica Imperial boiler, series No. 248w was used. The boiler was rated at 3,475 square feet of water radiation. From 40 to 50 per cent of auxiliary air was found best for smokeless combustion at high rates of combustion. At low rates the temperatures were too low. The economy was practically the same both with and without auxiliary air.

## THE COLLEGE OF AGRICULTURE, FORESTRY, AND HOME ECONOMICS

NOTE.—The current work of the Minnesota Agricultural Experiment Station is reviewed in the report of the director, Dean Walter C. Coffey, in the President's Report for the year 1924-25, *Bulletin of the University of Minnesota*. (In press.)

### AGRICULTURAL BIOCHEMISTRY

ROSS A. GORTNER, Ph.D., Professor of Biochemistry and Chief of the Division of Biochemistry.

1. (With W. F. Hoffman.) Physico-Chemical Studies on Proteins. I. The Prolamines, Their Chemical Composition in Relation to Acid and Alkali Binding. *Colloid Symposium Monograph*, 2:209-368. 1924.

The known alcohol soluble proteins from wheat, spelt, rye, oats, barley, corn, and kafir; and the unknown alcohol soluble proteins from durum, einkorn, teosinte, and sorghum were prepared and analyzed. Casein and fibrin were also prepared and analyzed. The data on the elementary analyses did not show any striking differences between the various proteins. The nitrogen distribution, the free amino nitrogen, the free carboxyl groups, the true ammonia nitrogen, and the tryptophane and cystine content of those proteins were studied. There were marked differences between the proteins of different groups, i.e., wheat or corn group. The differences between the proteins belonging to the same group were not sufficient to show any clear-cut subdivisions. The acid and alkali binding of the various proteins was studied by employing potentiometric methods. It is suggested that there are two types of combination between proteins and acid and alkali. (1) a chemical type of combination which takes place between a hydrogen ion concentration represented by pH 2.5 and pH 10.5 and (2) an adsorption type of combination which takes place when the hydrogen ion concentration is greater than pH 2.5 or the hydroxyl ion concentration is greater than pH 10.5.

The limitations of space do not permit a complete abstract of this monograph.

2. (With W. F. Hoffman.) Physico-Chemical Studies on Proteins. II. Alkali Binding. A Comparison of the Electrometric Titration of Proteins and of Phosphoric Acid with Sodium and Calcium Hydroxides. To be published in the *Journal of Physical Chemistry*, June, 1925.

Phosphoric acid and the proteins, casein and durum, have been titrated electrometrically with both sodium and calcium hydroxide, and "back titrated" with hydrochloric acid. The alkali titration curves of casein and fibrin show binding of alkali at about pH = 5.5 and resemble the curve for a weak acid such as monosodium phosphate. Other proteins, of which durum is a type, behave as much weaker acids, beginning to bind alkali only at about pH = 10.0. The same type of curves is obtained when a protein is titrated with either sodium hydroxide or calcium hydroxide. When phosphoric acid is titrated with sodium hydroxide and calcium hydroxide, the two curves are not similar. In the latter case, both the secondary and tertiary hydrogens are replaced by calcium at the same pH at which di-sodium phosphate is formed. The titration curves of protein + alkali and of phosphoric acid + alkali are not identical at similar hydrogen ion concentrations with the curves formed by a subsequent "back titration" with hydrochloric acid. There is a "lag" in the back titration curves. This "lag" is shown to be due to the reaction; not going





to completion resulting in an equilibrium and the presence of free hydrochloric acid which increases the hydrogen ion concentration. All three hydrogens of phosphoric acid may be titrated by calcium hydroxide below a pH of 8.0. The bearing of this observation on the graphic structure of di-calcium phosphate and tri-calcium phosphate is discussed. Tri-calcium phosphate is apparently stable in solutions as acid as pH 6.5. This has important bearing on physiological and biochemical problems.

3. (With W. F. Hoffman.) Evidence of a New Amino Acid in Proteins. *Journal of the American Chemical Society*, 47:580-84. 1924.

A new amino acid has been isolated from the protein teosinte. This amino acid was precipitated as the phosphotungstate under the conditions of the regular Van Slyke method of protein analysis after the ordinary bases had been precipitated and removed and the filtrate cooled to its freezing temperature. The pure amino acid was not prepared, as the crystalline preparation contained considerable ash in which barium predominated. The compound isolated was probably the barium salt. The present data indicate an empirical formula of  $\text{C}_4\text{H}_{11}\text{O}_3\text{N}$  or some multiple of this. The phenylisocyanate was prepared, m.p.  $140^\circ$  (uncorr.). The analysis of this derivative agrees with the apparent empirical formula. The work is being continued in an endeavor to isolate the pure amino acid and to study its physical and chemical properties.

4. (With W. F. Hoffman.) An Alcohol Soluble Protein Prepared from Rice.

Of all the cereals thus far examined, rice is the only one from which an alcohol soluble protein has not been prepared. The purpose of this investigation was to ascertain, if possible, whether or not an alcohol soluble protein could be isolated from rice, using hot alcohol as is necessary in the case of kafir, sorghum, etc. A protein has been isolated from rice by means of hot alcohol. This product was purified and is being analyzed for its nitrogen distribution as well as the carbon, hydrogen, and nitrogen content.

5. (With J. H. Lewis, H. G. Wells, and W. F. Hoffman.) An Immunological and Chemical Study of the Alcohol-Soluble Proteins of Cereals. *Proceedings of the Society for Experimental Biology and Medicine*, 22: 185-87. 1924.

The alcohol-soluble proteins from wheat, durum, spelt, einkorn, rye, oats, barley, corn, kafir, teosinte, and sorghum were tested by four different immunological methods, all giving identical results. These methods are the complement fixation test, the uterine strip method, the bronchospasm method, and the guinea pig anaphylaxis test.

The reactions brought out very clearly the relation of the proteins of wheat and corn types of cereals. The prolamines from emmer, einkorn, spelt, and durum are closely related to gliadin and glutenin from wheat, while those from teosinte and kafir are closely related to zein from corn. The former are more closely related to gliadin than they are to glutenin while the protein from teosinte is more closely related to zein than is kafir. No reactions were obtained between antisera for the corn group with proteins from the wheat group and conversely.

6. See also the studies by W. M. Sandstrom, H. M. Bennett, S. J. Dahl, J. A. Dunn, E. Grewe, and W. B. Sinclair.

CLYDE H. BAILEY,<sup>1</sup> Ph.D., Professor of Agricultural Biochemistry.

See studies by A. H. Johnson, R. C. Sherwood, A. Cairns, E. L. McIlhenny, A. G. Olsen, and H. O. Triebold.

<sup>1</sup> On leave of absence, 1924-25.

LEROY S. PALMER, Ph.D., Professor of Agricultural Biochemistry.

1. (With C. H. Eckles and Graduate Students.) A Study of the Vitamin Requirements of Growing Calves.

2. Yeast As a Supplementary Feed for Calves. (See abstract under C. H. Eckles, Department of Dairy Husbandry.)

3. (With C. H. Eckles and T. W. Gullickson.) A Study of a Nutritional Disturbance Similar to Osteomalacia among Cattle in Minnesota.

A careful study of the underlying causes of this disturbance, which is accompanied by a marked pica, is being made through a survey of the affected regions and a study of the mineral composition of the feeds, water, and soil in the same regions.

4. (With Cornelia Kennedy.) Studies on the Existence of a Fertility Vitamin Necessary for Normal Reproduction of Rats.

The postulation of Evans and Bishop that second generation young of rats can not be secured on a synthetic diet of casein, salts, butter fat, lard, and yeast because of the absence of a fertility vitamin has been studied during the past two years using a similar diet of casein, salts, butter fat, crisco (a hydrogenated vegetable oil), and yeast. The fact that second generation young have been reared and have reproduced normally on this diet shows either that a fertility vitamin does not exist or that the hydrogenated vegetable oil carries it. Great difficulty was encountered in successfully weaning the young born in each generation unless milk was added to the food of the mother during the nursing period. This result supports the belief in the existence of a special factor or factors necessary for normal lactation of this species of animal.

5. (With Cornelia Kennedy.) The Fundamental Food Requirements of Animals.

This is the major project of the nutrition section of this division. The work has been under way for four years. A critical study is being made of the hypothesis that adequate nutrition is secured by supplying an animal adequate energy, a single biologically adequate protein, a proper quantity and proportion of the nine commonly occurring mineral elements, and suitable amounts of vitamins A and B and C. There are many phases to this problem, each of which is essentially a distinct research problem in itself. Rats are being used as experimental animals. The diet is a synthetic diet of highly purified food constituents. Some of the results so far secured indicate (1) that another or other vitamins are required for growth, (2) that the hitherto unknown factors reside in natural foods, including milk, and its unpurified constituents, (3) that the functions of reproduction and lactation each demand either special combinations of the known biological food units or specific units of a vitamin nature.

6. (With G. A. Richardson.) The Colloid Chemistry of Rennin Coagulation.

The coagulation of milk by rennet has been explained by some investigators as due to the removal of some protective agent holding the casein complex of natural milk in its colloidal state. A study of the relation of gelatin, lactalbumin, and gum arabic to the clotting behavior of natural milk and pure calcium caseinate solutions has shown that these so-called protective colloids do not interfere with the rate or character of the clot unless they affect the calcium or hydrogen ion concentration of the milk. If either of these important factors is increased by the addition of solutions of the so-called protective agents clotting will be favored rather than hindered by the protective colloids. The colloid chemistry of rennin action is thus shown to be limited to the clotting or gelation of the paracasein formed by the action of rennin on casein, and the subsequent behavior of the jelly-like structure.

7. See also the studies by J. R. Haag, S. J. Dahl, O. Johnson, G. A. Richardson, and J. E. Richardson, under Agricultural Biochemistry, and by S. E. Bechdel, R. B. Becker, I. R. Jones, and L. M. Thurston, under Dairy Husbandry.

JOHN J. WILLAMAN, Ph.D., Associate Professor of Agricultural Biochemistry.

1. (With Francis Jager.) Use of Invert Sugar in the Winter Feeding of Bees.

By the use of commercial invertase it has been found perfectly feasible under home conditions to invert sucrose solutions of concentrations up to 75 per cent. The resultant sirup is very similar to honey in appearance and physical properties, and is superior to the ordinary sucrose sirup fed to bees in the fall for two reasons: (1) it has the same concentration as honey, whereas the sucrose sirup is rather dilute; (2) since in the fall and winter bees secrete very little invertase, invert sugar is more wholesome than sucrose.

2. (With R. M. West.) A Statistical Study of the Composition of Potato Tubers. *Minnesota Studies in Plant Science*, pp. 211-27, November, 1924.

In 1910 one of the writers (R. M. West) had made an extensive series of chemical analyses of potato tubers. There was on record also information as to the variety, location, type of soil, and yield for each sample. These data were subjected to various statistical analyses. The results are too extensive to be summarized within the limits of the available space.

The available facts concerning the composition and properties of potato tubers warrant the conclusion that it should be possible to breed a variety with a higher proportion of protein to carbohydrate, and still with desirable culinary properties. Such tubers would have a higher percentage of dry matter and they would be spheroidal rather than long or flat in shape.

3. (With G. O. Burr and F. R. Davison.) Corn Stalk Sirup Investigations. *Journal of Industrial and Engineering Chemistry*, 16:734. 1924.

The object of the investigation was to determine whether a commercial sirup could be made from sweet corn stalks as a cannery by-product. It was found that the maximum sugar content of the stalks is attained about 10 to 15 days after harvesting the ears for the cannery. The sugar content of the juice at this stage averages about 13 per cent, ranging from 9 to 16 per cent. The method of manufacture of the sirup is about the same as for sorghum sirup, with some modifications of the control of acidity. A good quality of palatable sirup can be made, which is very acceptable as a cooking sirup but not as a table sirup. The yields per acre are 3 or 4 tons of stalks from the smaller varieties to 9 or 10 tons from the larger. This will produce from 35 to 110 gallons of sirup. Because of these small yields, corn stalk sirup manufacture could be a commercial success only with the larger varieties.

4. (With C. P. Fitch.) The Nature of the Toxin in Some Lots of Sweet Clover Hay and Silage.

Many cases are now on record of particular lots of sweet clover hay and silage causing certain specific symptoms of disease in cattle, sheep, and chickens. Many times death ensues. An attempt is being made to isolate and identify the toxic principle, and to determine under what conditions it is formed.

5. (With J. H. Beaumont.) Respiration of Apple Twigs in Winter.

In the attempt to find the chemical basis of winter hardiness, the respiration of the twigs of hardy and of tender varieties of apples is being measured at controlled

winter temperatures. There is an appreciable production of carbon dioxide even at  $-10^{\circ}$  C. No conclusions can as yet be drawn as to the comparative respiration of hardy and tender trees.

6. (With H. O. Triebold and N. C. Pervier.) Biochemistry of Plant Diseases. V. Relation between Susceptibility to Brown Rot in Plums and Physical and Chemical Properties. *Botanical Gazette*. (In press.)

The attempt has been made to relate the resistance and susceptibility of plum varieties to brown rot to their chemical and mechanical characteristics. To this end 11 varieties were analyzed at 6 stages of ripeness during the seasons of 1922 and 1923. Crude fiber, pentosans, and dry matter analyses were made, and the toughness of the skin and the firmness of the flesh were measured. It has been found in general that the resistant varieties have a higher crude fiber content than the susceptible, and that this holds more in the ripe than in the unripe stages of maturity. The pentosan content shows somewhat the same relations to susceptibility as does the crude fiber, but to a lesser degree. Although the toughness of the skin decreases in all varieties as ripeness proceeds, the change is more marked in the susceptible varieties. The firmness of the flesh of plums parallels to a striking degree the toughness of the skin in all stages of maturity. When the plums become ripe, and especially when overripe, the above relations tend to disappear.

7. See also the studies by K. W. Frankel, D. R. Briggs, S. M. Hauge, A. K. Anderson, H. Letcher, and J. F. Frost, under Agricultural Biochemistry; and J. J. Christensen, under Plant Pathology.

WALTER F. HOFFMAN, Ph.D., Assistant Professor of Biochemistry.

1. The Electrodialysis of Agar: A Method for the Preparation of the Free Agar Acid. (In press.)

Commercial agar (0.5 per cent suspension) was electrodialyzed for 18 hours using a total of approximately 11.65 ampere hours at a potential of 220 volts. This treatment removed the calcium quantitatively from the agar, but none of the sulfur was lost. The free acid thus formed and diluted to a one per cent suspension has a hydrogen ion concentration of pH 2.475. The acid is about 56 per cent ionized as measured by the actual and apparent acidity. The acid is neutralized by sodium hydroxide below pH 4.0. Solutions of the free acid, even up to 5 per cent, do not set to a gel when cooled. Appreciable auto-hydrolysis takes place when suspensions of the free acid are heated. When the free acid is neutralized with bases, rigid gels are obtained. Organic bases also form salts with the agar acid and set to rigid gels. The gelation of agar is the gelation of a salt and not the gelation of a complex polysaccharide. It is suggested that the change taking place when an agar suspension is electrodialyzed is the removal of the calcium from the agar molecule and its replacement by hydrogen.

2. See several other studies listed under R. A. Gortner; also the study by T. A. Pascoe, and five studies with J. Arthur Harris, Department of Botany.

ARNOLD H. JOHNSON, Ph.D., Assistant Professor of Agricultural Biochemistry.

1. The Baking Properties of Ether Extracted Flours.

It has been found that the addition of phosphatides to flour doughs resulted in the production of bread inferior to the bread baked from the normal doughs. It might be anticipated, therefore, that the removal of the phosphatides by extraction with ether would result in the production of bread of improved baking qualities.



In the instance of several patent flours the bread baked from the extracted flour was notably superior to that baked from the natural flour in both texture and color, the loaf volume being about the same for the natural flour as for that extracted with ether. Research is now in progress to determine the effects of ether extraction on the baking properties of patent and clear flours. Since clear flours are higher in their phosphatide content than patent flours, ether extraction should effect a greater improvement in baking properties in the instance of the clear flour than in the instance of the patent flour.

## 2. (With C. H. Bailey.) The Effect of Various Ions on Yeast Fermentation in Bread Doughs and on the Physical Properties of the Dough.

When used in bread-making certain salts are known to stimulate yeast activity; others are known to exert beneficial effects on the physical properties of the gluten; and still others operate both to stimulate yeast activity and to modify the properties of the gluten. Thus ammonium chloride was shown to accelerate yeast activity due to the ammonium ion alone. Ammonium, potassium, persulphate, and chloride ions when added to the dough in any combination accelerate carbon dioxide production only when the ammonium ion is one of the ions present.

Phosphates stimulate yeast activity when added to the dough. The effect of added phosphate is not nearly so marked as might be expected due probably to the fact that phosphates already present in the dough render less significant the effect of the added phosphate. Phosphates, moreover, are known to effect an improvement in the physical condition of the gluten. The effect of acid phosphates, however, is rendered insignificant due probably to the effect of solvent action of the phosphate on the gluten.

Aluminum ions also operate to increase the capability of the dough to retain carbon dioxide. Very small quantities of the aluminium ion are very effective in this regard.

## 3. The Use of Proteolytic Enzymes for Conditioning the Dough for Cracker Manufacture.

It has recently been pointed out that during the fermentation of a cracker sponge with yeast a proteolysis of flour protein occurs and then this proteolysis results in a "conditioning" of the dough for cracker manufacture. Since losses due to fermentation are considerable, research has been undertaken to ascertain whether proteolytic enzymes may be used rather than yeast for the "conditioning" process. Results thus far indicate that proteolytic enzymes effect the same change of properties of the flour proteins as does extended fermentation with yeast in so far as could be determined by laboratory methods. The process has been applied experimentally in the cracker industry, but the research must be carried farther before the general applicability of the process can be established.

## 4. The Identification and Estimation of the Organic Acids Produced during Cracker Dough Fermentation.

During the normal course of fermentation in bread and cracker doughs there results a marked increase in hydrogen ion concentration. This research concerned itself with a determination of the factors involved in increasing the acid-reacting materials present in cracker sponges, bread doughs, and flour-water suspensions fermented with yeast. These factors are carbon dioxide produced by the yeast, acid phosphate salts produced by phytase phytin phenomena, and organic acids produced by the yeast or other organism present in the media. The results for each factor have been worked out, but are too extensive to be summarized briefly.

## 5. (With C. H. Bailey.) Gluten of Flour and Gas Retention of Wheat Flour Doughs. *Cereal Chemistry*, 2:95-106. 1925.

Gluten content has an important bearing upon the baking strength of flour. When the percentage of gluten in flour is reduced by dilution with starch, the gas retaining power of dough made from such flour is impaired. Gas-producing capacity

is not necessarily impaired by such additions of starch. Gas-retaining capacity of wheat flour doughs is impaired by treating them with 96 per cent alcohol and with water. Such modifications of properties as are effected by these treatments may be attributed to the alteration of the colloidal condition of the glutenin. Rye flour dough has a low gas-retaining capacity although the rate of gas production in the dough is high. The inferior gas-retaining capacity is probably responsible for the dense compact loaves that are ordinarily baked from pure rye flour.

6. (With C. H. Bailey.) A Physico-chemical Study of Cracker Dough Fermentation. *Cereal Chemistry*, 1:293-304. 1924.

Two devices are described for conveniently measuring the rate of loss of carbon dioxide from fermenting bread doughs. The first method involves two determinations, in one of which the expansion of the dough plus the loss of carbon dioxide gas is registered, while in the second only the expansion of the dough is recorded. The difference between these values represents the quantity of carbon dioxide lost from the dough, which, when plotted against time, gives a curve representing the comparative rate of carbon dioxide loss. In the second device, involving modifications of the Osterhout apparatus, merely the rate of carbon dioxide loss is observed. The values thus determined are, however, convenient criteria of the stage of fermentation. After a lapse of 100 to 180 minutes, depending upon the characteristics of the flour and other ingredients of the dough, a sudden increase in the rate of loss of  $\text{CO}_2$  will be observed. The comparative time required to effect this change in rate affords a convenient measure of the properties of a flour in a standard formula, and may be correlated with the optimum fermentation period for flours under observation.

7. See also the studies by P. Brown, J. A. Dunn, E. Grewe, E. L. McIlhenny, Z. R. Ristich, H. O. Triebold, and H. A. Vogel.

CORNELIA KENNEDY, Ph.D., Assistant Professor of Agricultural Biochemistry.

1. (With L. S. Palmer.) The Antirachitic Value of Mothers' Milk.

The fat of mothers' milk under different dietary conditions of the nursing mother is being tested for its antirachitic value, using rats as experimental animals. The experiments are being conducted in part, with the co-operation of F. W. Schlutz, Department of Pediatrics, and H. C. Kernkamp, Division of Veterinary Medicine. The work is in progress and can not be reported in detail.

2. See also two studies listed under L. S. Palmer.

ARTHUR K. ANDERSON, Ph.D., formerly Instructor in Agricultural Biochemistry.

Biochemistry of Plant Diseases. I. Biochemistry of *Fusarium lini* Bolley. *Minnesota Studies in Plant Science*, 5:237-80. 1924. (Thesis for the Ph.D. degree; J. J. Willaman, Adviser.)

The general object of this series of investigations is to arrive at a better understanding of the chemical reactions of both host and parasite, and the chemical relations between them. In this investigation a quantitative study of the carbon metabolism of *Fusarium lini* was made. *Fusarium lini* is not sensitive to extremes of hydrogen ion concentration of the medium on which it grows. The change in reaction is such as to bring the final reaction within the range for good growth. The dry matter produced on media with potassium nitrate, aspartic acid, urea, asparagin, and ammonium sulfate as the only sources of nitrogen decreases in the above order. *Fusarium lini* grows well on all the following carbohydrates as an only source of carbon: glucose, levulose, galactose, mannose, xylose, sucrose, maltose, lactose, soluble starch, and inulin. The products of metabolism on glucose and on xylose are mainly carbon dioxide and ethyl

alcohol, with traces of succinic acid and glycerol. The ratio of carbon dioxide to ethyl alcohol from glucose is nearly that of a typical yeast fermentation. The proportion of carbon in alcohol to carbon in carbon dioxide on a xylose medium is nearly 1:1 as compared to 2:1 in the case of a glucose medium. The highest concentration of alcohol so far obtained is 4.33 per cent by volume.

J. ROY HAAG, M.S., Instructor in Agricultural Biochemistry.

The Antagonism of Certain Ions in the Nutrition of Higher Animals. (Thesis for the Ph.D. degree; L. S. Palmer, Adviser.)

Certain ions are known to be biologically antagonistic, but the importance of this fact for nutrition has not been adequately studied. The present study forms a portion of a co-operative research project by the divisions of Agricultural Biochemistry and Dairy Husbandry on the fundamental factors involved in a widespread nutritional disturbance among the livestock of Minnesota, which is apparently due to either a mineral deficiency or a disturbance in mineral metabolism or both. Definite results of this portion of the study can not be presented.

WILLIAM M. SANDSTROM, B.A., Instructor in Agricultural Biochemistry.

1. Physico-chemical Studies on Derived Proteins. (Under the direction of R. A. Gortner.)

Certain derived or altered proteins are being studied by physico-chemical methods with especial reference to acid and alkali binding capacity. The methods are essentially those outlined by Hoffman and Gortner, *Colloid Symposium Monograph*, 2:209-368, 1925. Sufficient data have not as yet been obtained to justify the drawing of conclusions.

2. Proline and Tryptophane As Factors Influencing the Accuracy of Van Slyke's Method of Nitrogen Distribution in Proteins. *Journal of the American Chemical Society*, June, 1925. (Thesis for the M.S. degree; R. A. Gortner, Adviser.)

When tryptophane was added to a mixture of 14 amino acids, the analysis of the unboiled sample showed appreciable errors in the basic fraction and in the amino nitrogen and total nitrogen in the filtrate from the bases. The errors in the basic nitrogen affect chiefly the arginine fraction. When the mixture was boiled for twenty-four hours with 20 per cent hydrochloric acid the ammonia and histidine fractions showed appreciable errors. Proline added to a similar mixture of amino acids precipitates in part with phosphotungstic acid and errors are introduced in the arginine, histidine, and lysine fractions. The same results were obtained when the mixture of amino acids were boiled with hydrochloric acid for twenty-four hours prior to analysis. Both proline and tryptophane may, if present, introduce errors in the Van Slyke method for the nitrogen distribution of proteins.

REGINALD C. SHERWOOD, Ph.D., Instructor in Agricultural Biochemistry.

The Control of Diastatic Activity in Wheat Flour. (Thesis for the Ph.D. degree; C. H. Bailey, Adviser.)

Experimental work has shown that germinated wheat may be utilized as a means of supplementing diastatic activity of wheats which are deficient in this regard. Catalase activity was found to be an index of the extent of germination.

Wheat sprouted three days under carefully controlled conditions proved satisfactory, while that sprouted five days underwent changes which rendered it much less desirable as a source of diastases. Large percentages of germinated wheat induced enormous increase in diastatic activity and large increase in loaf volume but when the germination period was long, other changes coincident with this increase resulted in inferiority in the finished loaf of bread. A percentage of germinated wheat which will bring the diastatic activity of the flour into the range of 200 to 250 has been

shown to improve the baking quality of the flour. It was practical and interfered in no way with the milling process to add small percentages of germinated wheat on a commercial scale. Two and 3 per cent of wheat germinated for three days were found to produce very desirable results causing 100 per cent increase in the diastatic power of straight grade flour. Protease activity was but slightly increased.

HAROLD M. BARNETT, Assistant in Agricultural Biochemistry.

Physico-chemical Studies on Proteins. Electrical Conductivity and Ion Concentration Studies of Protein Compounds. (R. A. Gortner, Adviser.)

In this investigation it is planned to study the amount of acid (hydrochloric) or alkali (sodium hydroxide) bound by a protein by measuring both the hydrogen and chlorine ion and the sodium ion concentrations potentiometrically. About twenty proteins will be used. Fourteen of these have been used in previous work, and the results of their analyses reported. The others will be analyzed by identical methods.

The results obtained from such a series of determinations will be correlated with the chemical properties and analyses of the proteins. These, together with a study of the transport numbers, etc. will be used in an attempt to throw further light on the binding of acid and alkali by proteins.

ANDREW CAIRNS, B.S., formerly Fleischmann Fellow in Agricultural Biochemistry.

1. The Proteolytic Activity of Wheat Flours. (Thesis for the M.S. degree; C. H. Bailey, Adviser.)

One phase of flour strength research which has received only slight attention is that concerned with the proteolytic enzymes present in the flour. Among the methods which have been used is the determination of amino nitrogen in digested flour—water suspensions, which have been clarified through the use of various reagents, by means of the Van Slyke apparatus, the Sorensen formal titration, and the Sorensen titration as modified by Forman. Viscometric methods may also prove useful in following protein cleavage during auto-digestion of flour-water suspensions. Several hundred flours have been collected and the methods suggested above are being used in the investigation of their proteolytic activity. Various other constants significant in flour strength are also being determined on these same flours in order that correlation between these constants and flour strength may be worked out if such correlations exist.

2. See also study listed under Agricultural Economics.

SELMER J. DAHL, M.S., Assistant in Agricultural Biochemistry.

A Study of Certain Indolinones. (Thesis for the M.S. degree; R. A. Gortner and L. S. Palmer, Advisers.)

The behavior of beta-methyl and beta-propyl indolinones both as protectors against, and cures for, polyneuritis in pigeon was studied. Neither compound was able to protect the birds against loss of weight in a polished rice diet or against the incidence of polyneuritis. Betamethyl indolinone was found to have a slight curative effect. Thyroxin, an indolinone-like compound, also failed to protect against loss of weight on a polished rice diet and gave no conclusive evidence of relieving polyneuritis. Pilocarpine hydrochloride also had no preventive antineuritic properties.

EMILY GREWE, M.A., Fleischmann Fellow in Agricultural Biochemistry.

Glutenin and Flour Strength. (Thesis for the Ph.D. degree; R. A. Gortner and A. H. Johnson, Advisers.)

During the last few years evidence has been obtained indicating that glutenin plays an important rôle in flour strength. The purpose of this work is to study the



relationship between glutenin content and flour strength. In determining strength of flour, total protein, diastatic action, the baked loaf of bread, the baking test modified according to the diastatic activity of the flour, the extensibility, the viscosity, and the hydrogen ion concentration will be considered. Effort is being made to establish correlations between the various protein fractions of the flour such as the total protein, the protein soluble in 5 per cent potassium sulfate solution, the protein soluble in 70 per cent alcohol, and the protein insoluble in alcohol. In this study flours of widely differing characteristics as regards baking properties are being used. The flours under investigation were milled from wheats grown in all regions of the United States including the hard Canadian and Montana wheats and the extremely soft wheats of California.

SIGFRED M. HAUGE, M.A., formerly Assistant in Agricultural Biochemistry.

The Influence of Reaction on the Adsorption of Dyes by Chars. (Thesis for the Ph.D. degree; J. J. Willaman, Adviser.)

A series of chars from both vegetable and animal sources, was secured, and their adsorbing action towards caramel, methylene blue, picric acid, and other dyes was determined for a long range of hydrogen ion concentrations. Kataphoresis of the chars at the various reactions was also determined. The results as yet do not warrant the drawing of conclusions.

OTTO JOHNSON, B.A., Assistant in Agricultural Biochemistry.

The Gold Number of the Protective Colloids of Cow's Milk. (Thesis for the M.S. degree; L. S. Palmer, Adviser.)

The relative protective effect of the various colloids of milk and the factors which affect this property have never been studied. Data are being secured along this line for the various alkali and acid caseinates at different hydrogen ion concentrations, for lactalbumin at different hydrogen ion concentrations, for the alcohol soluble protein of milk and for the special emulsion-stabilizing phosphates-protein complex adsorbed on the surface of the fat globules.

HOUSTON LETCHER, M.S., Assistant in Agricultural Biochemistry.

Alcohol Production by *Fusarium Lini*. (Thesis for the M.S. degree; J. J. Willaman, Adviser.)

*Fusarium lini*, the fungus causing flax wilt, has been cultured on six different saccharine media, and it produced ethyl alcohol on all of them. The alcohol reaches a maximum concentration and then decreases. This confirms the earlier observations of Anderson. In general the maximum alcohol content of the culture media is attained in approximately thirty days. The alcohol production by eight strains of the fungus ranged from 0.80 to 2.99 per cent 30 days after inoculation. The highest percentage for any single culture was 3.7. The three strains of the organism which were the least virulent in their action on the flax plant had the lowest alcohol production. Acetaldehyde is apparently one of the intermediate products formed by the fungus in fermenting sugars. The acetaldehyde so derived is present at any given time only in traces, as shown by colorimetric and titrimetric methods.

EDWARD L. MCILHENNY, B.S., Assistant in Agricultural Biochemistry.

The Shortening Power of Fats. (Thesis for the M.S. degree; C. H. Bailey and A. H. Johnson, Advisers.)

Fats differ in their efficiency as shortening agents, hence some method of measuring the shortening power of fats would be desirable. A shortometer was devised for use in this regard. A standard baked product containing the fat in question was prepared and the force required to break this cake was taken as a measure of the shortening power. Thus the smaller the force required to break a cake containing a unit quantity of fat, the greater the efficiency of that fat as a shortening agent. In

addition to testing various fats and oils by this method, it is proposed to emulsify or homogenize the several fats and note the effects of these mechanical treatments on the shortening powers of the fats. By means of this type of research it is believed that a more accurate value as regards shortening power can be assigned to various fats and oils and that a deeper insight may be gained in the mechanism of shortening phenomena.

AKSEL G. OLSON, M.S., formerly Fleischmann Fellow in Agricultural Biochemistry.

A Study of the Proteases of Bread Yeast. *Cereal Chemistry*, 2:68-86. 1925. (Thesis for the M.S. degree; C. H. Bailey, Adviser.)

Substantial changes in the physico-chemical properties of gluten of wheat flour in a dough or flour suspension may result from yeast fermentation. Glutenin is the protein presumably chiefly involved in the changes which were studied. Water-imbibing capacity as measured by the viscosity of flour suspensions afforded a convenient criterion of the modification of glutenin which occurred during fermentation with yeast.

Reduction in water-imbibing capacity of gluten can not be attributed to proteases contributed by living, normal yeast cells, but rather to the increased hydrogen-ion concentration of the flour suspension undergoing fermentation. Addition of dilute acids to a yeast-free flour suspension resulted in essentially the same modifications of the glutenin as occurred in normal fermentation with yeast. When dilute alkali was periodically added to the fermenting mixture to prevent increases in hydrogen-ion concentration, the extent of change in water-imbibing capacity of the glutenin was slight.

The results in detail are too extensive for brief summary. However, the observations indicate that the proteases contributed by sound, normal intact yeast cells (bakers' yeast) are negligible in their effect upon the properties of gluten during a 4- or 5-hour fermentation period.

TRUMAN A. PASCOE, B.S., Assistant in Agricultural Biochemistry.

Physico-chemical Study of Strong Electrolytes. (W. F. Hoffman, Adviser.)

The physico-chemical measurements most commonly made on biological fluids are (1) depression of the freezing point or osmotic pressure (2) the specific electrical conductivity and (3) the ion (principally hydrogen) concentrations. The first is a measure of the total number of solutes, the second is primarily a measure of the salt or electrolyte concentration while the third is a measure of the particular ion concentration. It has been shown by previous workers that these methods do not give the same ionization constants for even a pure salt. After all of these measurements have been made on a biological fluid only a rough qualitative estimation of the various constituents (inorganic) is possible.

In this work it is planned to measure the freezing point depression, the electrical conductivity and the ion concentrations of varying concentrations of pure salts and mixture of various salts. These results will be used in an attempt to interpret more definitely the results obtained on biological fluids.

G. ARTHUR RICHARDSON, M.S., Assistant in Agricultural Biochemistry.

Factors Influencing the Coagulation of Milk by Rennin. (Thesis for the M.S. degree; L. S. Palmer, Adviser.)

The problem of rennin activity has been approached through the study of the comparative behavior of solutions of pure casein and paracasein towards rennin and through a study of the comparative chemical binding by casein and paracasein of hydrochloric acid, sodium hydroxide, and calcium hydroxide. Solutions of calcium caseinate have been found to clot with rennin if the solutions contain free calcium and the pH

is within the limits of clotting of natural milk. Solutions of calcium paracaseinate are not clotted by rennin but are very sensitive to calcium ions and can be clotted by monovalent ions, e.g. by sodium chloride. Between a range of hydrogen ion concentration represented by  $\text{pH} = 2.5$  to  $11.0$  casein and paracasein have been found to possess different acid- and base-combining capacities. Paracasein has uniformly the higher binding capacity, ranging from  $1.4$  to  $5.0$  times that of casein for base and from  $1.4$  to  $4.0$  times that for acid, depending upon the  $\text{pH}$  of the solution.

ZHIVOJIN R. RISTICH, B.S., Assistant in Agricultural Biochemistry.

Diastatic Activity of the Mill Streams at Controlled Hydrogen Ion Concentrations. (A. H. Johnson, Adviser.)

One of the criticisms of the method commonly used in determining the diastatic activity of flours has been that the hydrogen ion concentration has not been controlled. Moreover, little work has been done on the diastatic activity of various grades of flour or on the mill streams. In this work the diastatic activity of a series of mill streams will be determined and these determinations made at several different known hydrogen ion concentrations. Since diastatic activity is a phase of flour strength which has received little investigation, it is believed that the result will be a contribution to our knowledge of this subject.

WALTON B. SINCLAIR, B.S., Assistant in Agricultural Biochemistry.

The Effect of Alkali on Cystine. (Thesis for the M.S. degree; R. A. Gortner, Adviser.)

It has been known for many years that the amino acid, cystine, is readily decomposed in the presence of fixed alkalies but no study has been made as to the rate of decomposition or the nature of the carbon compound or compounds formed on decomposition. This study has as its aim these two objects.

The rate of loss of carbon dioxide, ammonia, and hydrogen sulfide from boiling alkaline cystine solutions has been followed quantitatively. The loss of ammonia and hydrogen sulfide proceeds rapidly but carbon dioxide is lost very slowly. An attempt was made to isolate the carbon compounds remaining after prolonged alkali boiling and at least two different substances have been obtained. These are acids. Their identification is not as yet complete.

HOWARD O. TRIEBOLD, B.S., Strietmann Fellow in Agricultural Biochemistry.

1. Rancidity in Baked Products. (Thesis for the M.S. degree; A. H. Johnson and C. H. Bailey, Advisers.)

Certain fats and oils when used in baked products become rancid more readily than others. Research is in progress to correlate, if possible, this susceptibility to become rancid with various significant factors in regard to the fat such as origin of the fat (i.e. whether derived from plant or animal) method of manufacture, free fatty acid content, degree of unsaturation, melting point, induction period (i.e. time required before rapid oxidation begins when the fat is heated) hydrogen ion concentration of the baked product, etc. Products baked from the respective fats have been collected and the developing rancidity of these products noted. The baked products also are being heated in an atmosphere of oxygen in order to determine the induction period of the fat in the baked product. Since the development of rancidity is due to oxidation it is believed that the determination of the induction period will give reliable information concerning the susceptibility of the fat to rancidity.

2. See also study (Number 6) listed under J. J. Willaman.

PEARL BROWN, B.S., Undergraduate Student.

The Use of the Stormer Viscosimeter in Flour Strength Studies. (A. H. Johnson, Adviser.)

Several types of viscosimeter have been recommended for use in determining the viscosity of acidulated flour-water suspensions among which is the Stormer viscosimeter. A detailed study of this instrument indicates that it is not suitable for use in flour strength research. Due apparently to mechanical imperfections of the instrument, it was not possible to obtain check readings at high viscosities. At high viscosities successive readings on the same preparation were found to vary as much as 20 per cent. In several instances separate flour-water suspensions prepared in the same manner had viscosities as measured on this instrument which differed by 50 per cent. In carrying out this study several types of rotating bob were used and different forces applied to rotate the bob. In all cases, however, the results were such as to indicate the impracticability of using the Stormer viscosimeter for measuring the viscosity of flour-water suspensions.

JOSEPH A. DUNN, B.S., Graduate Student.

Plasticity Studies on Flour. (Thesis for the Ph.D. degree; R. A. Gortner and A. H. Johnson, Advisers.)

Research in the field of the chemistry of flour strength has indicated that a relationship exists between the so-called viscosity of acidulated flour-water suspensions and flour strength. The measurable quantity called viscosity is probably the resultant of two properties of the acidulated suspension, the viscosity and the plasticity. Effort is being made to develop methods for distinguishing the viscosity of flour preparations from their plasticity. It is hoped that this research may lead to correlations between flour strength and the factors involved in the term viscosity as it is now applied.

KURT W. FRANKE, M.S., and DAVID R. BRIGGS, M.A., Cloquet Wood-Products Fellows in Agricultural Biochemistry.

Chemical Studies on Forest Products. (J. J. Willaman, Adviser.)

A project has just been begun on the chemical study of wood utilization with special reference at present to the manufacture of paper and to the more accurate chemical control of the pulp cooking process.

JESSIE E. RICHARDSON, B.S., Graduate Student.

The Inter-Relation of Carriers of Vitamines A and B as Affecting Growth and Tissue Change of Young Animals. (Thesis for the Ph.D. degree; L. S. Palmer, Adviser.)

When young rats are limited to certain types of synthetic diets, apparently adequate for growth, they fail to develop and marked abnormalities of the fur accompany the failure to grow. These results are being studied with reference to the effect of certain vitamin carriers as well as inter-relations of vitamins A and B to the abnormalities.

JOHN F. TROST, M.S.A., Graduate Student.

The Development of Enzymes during the Germination of Wheat. (Thesis for the Ph.D. degree; J. J. Willaman, Adviser.)

Sprouted wheat is of unknown importance in the flour industry, since it is not known when it is harmful and when it is beneficial. It affects flour because of its enzyme activities. Therefore, wheat is being germinated under various conditions and for various lengths of time, and determinations are being made of the activity of the enzymes in each lot of wheat.



HOWARD A. VOGEL, B.S., Graduate Student.

Physico-Chemical Properties of Durum Flours. (Thesis for the M.S. degree; A. H. Johnson, Adviser.)

Cereal research has been confined for the most part to the wheats used in bread-making. It seemed worth while to apply the same type of research to durum flours. A considerable number of durum flours were accordingly collected, and they are being subjected to the research methods developed in modern cereal chemistry. Among the more important of the determinations which are being carried out are hydrogen ion concentration, viscosity, diastatic activity, glutenin content, and Chopin extensimeter value. By this research it is hoped that fundamental differences between bread flours and durum flours will appear.

### AGRICULTURAL ECONOMICS

JOHN D. BLACK, Ph.D., Professor of Agricultural Economics and Chief of the Division.

1. (With L. C. Gray, U. S. Department of Agriculture.) Land Settlement and Colonization in the Great Lakes States. *United States Department of Agriculture Bulletin* No. 1295. 1925. 88 pages.

The purpose was to determine the conditions essential to success in selling and colonizing cut-over land in the Lakes States. A field study was made of 2,000 settlers and 153 land-selling agencies. Analysis of data. Eleven field men assisted in collecting the data.

2. (With H. R. Tolley and M. J. B. Ezekiel, U.S. Department of Agriculture.) Relation of Output to Input in Agricultural Production. *United States Department of Agriculture Bulletin* No. 1277. 1924. 44 pages.

To develop methods for showing the relation of input to output in various types of agricultural production; and also to show the uses to which such data may be put. Statistical analysis was made of such data from previous studies as could be used. The results show the input as related to output in farm organization and cost-of-production studies.

3. (With Budd A. Holt and G. M. Peterson; also A. V. Swarthout, U.S. Department of Agriculture.) Economic Aspects of Local Potato Warehouse Organization. To be published in *University of Minnesota Agricultural Experiment Station Technical Bulletin* No. 27.

To determine the elements of efficiency in the economic organization of local potato warehouses in Minnesota. Records of seventy-one local potato warehouses were collected by the survey method in large part.

4. (With E. S. Guthrie of Cornell University and R. C. Potts of the U.S. Department of Agriculture.) Economic Aspects of Local Creamery Organization. To be published in *University of Minnesota Agricultural Experiment Station Technical Bulletin* No. 26.

To develop methods of analyzing marketing business unit data so as to discover the elements of efficiency in organization. Analysis of field data from 102 Minnesota creameries. Data collected by E. S. Guthrie.

5. See also the studies by B. M. Gile, G. M. Peterson, A. R. Upgren, C. C. Zimmerman, R. C. Ballinger, A. G. Black, A. Cairns, O. O. Churchill, G. H. Fredell, C. H. Hammar, F. J. Hosking, H. Metzger, L. I. Myers,

E. Rauchenstein, E. A. Reese, B. Smith, J. J. Scanlon, G. S. Sulerud, T. Sundstrom, and N. Wall; also that by W. C. Waite (School of Business, Department of Economics).

H. BRUCE PRICE, Ph.D., Associate Professor of Agricultural Economics.

1. (With C. M. Arthur and E. C. Johnson.) Business Practices of Farmers' Local Grain Elevators. To be published as a *University of Minnesota Agricultural Experiment Station Bulletin*.

The purpose was to assist farmers' elevators with management problems of buying, selling, hedging, storing, financing, and other problems of operation. Audits were made of 300 elevators covering a seven-year period 1918 to 1924, with personal visits to 85 elevators. Interviews were held with grain commission firms and terminal elevator companies at Minneapolis.

2. (With C. R. Hoffer, Department of Sociology and C. J. Galpin, U.S. Department of Agriculture.) Farmers' Supply Service. To be published as a *University of Minnesota Agricultural Experiment Station Bulletin*.

The purpose is to analyze the efficiency of the supply service which farmers are securing from local stores and other local agencies. The investigation was made through a survey of stores in twelve Minnesota towns, questionnaires to co-operative stores, survey of local elevators, etc.

3. See also the studies by A. R. Upgren, A. Cairns, H. Metzger, and T. Sundstrom.

HOLBROOK WORKING, Ph.D., Associate Professor of Agricultural Economics.

1. Factors Influencing the Price of Minnesota Potatoes. *University of Minnesota Agricultural Experiment Station Technical Bulletin* No. 29.

To determine a practical means of measuring the economic forces influencing the price of potatoes as a basis for forecasting price movements. Statistical study of potato prices in St. Paul and Minneapolis were studied in connection with data on the various factors thought to influence price.

2. The Statistical Determination of Demand Curves. To be published in the *Quarterly Journal of Economics*.

To determine the possibilities and limitations of statistical measurements of demand as a basis for estimating the usefulness of past studies and indicating the lines along which future studies should proceed. A review of existing studies and analysis of characteristics of methods used.

3. Factors Influencing the Differential between the Price of Potatoes in St. Paul—Minneapolis and the Price in New York City. To be published in the *Journal of Agricultural Economics*.

To throw further light on the factors influencing the prices of potatoes in the various markets and the manner in which they operate. The study includes a statistical analysis of prices and other pertinent data.

4. Causes of Changes in the General Price Level.

The purpose is to check results previously obtained and published (*Quarterly Journal of Economics*, 1923), to provide a means for their practical utilization, and to determine more completely their explanation and significance. The study includes a statistical analysis of existing data.

## 5. Bank Deposits As a Business Barometer. (Unpublished.)

## 6. Forms of Frequency Distributions of Economic Series and Their Bearing upon Methods of Measuring Seasonal Variation.

To throw light on the relative merits of the more laborious as compared with the simpler methods of calculating seasonal variation. The method used is the charting of frequency distributions with significant statistical measures, determination of relative probable errors of different averages and their influence in the result. (Uncompleted.)

## 7. Factors Influencing the Price of Corn.

A preliminary study to determine the factors of importance for subsequent investigation. A statistical analysis of existing data. (Unfinished.)

## 8. Trends of Prices of Farm Products.

This work was undertaken, with substantial aid from numerous graduate students in the seminar on Prices of Farm Products, to determine the factors influencing the trends of prices of the various farm products and provide a basis for forecasting future trends. The method used was the compilation of data on prices of important farm products since 1840, analysis of methods of measuring influence of general price level and of the relation of price to cost of production, and study of trends of values in connection with related economic phenomena. (Results are incomplete.)

9. See also the studies by B. A. Holt, J. Hendel, F. J. Hosking, and T. G. Stitts.

BUEFORD M. GILE, B.S., Instructor in Agricultural Economics.

Farm Credit in Minnesota. (Thesis for the M.A. degree; under the direction of J. D. Black, G. W. Dowrie, and N. A. Olsen.)

To determine the credit condition of the farmers of Minnesota and the adequacy of present credit facilities. A field study of 250 farmers in 6 areas, supplemented by data available in official records and the like. (Results incomplete.)

BUDD A. HOLT, M.A., Instructor in Agricultural Economics.

1. The Influence of Distribution or Production on Price Differentials between Potato Markets. (Thesis for the Ph.D. degree; Holbrook Working, Adviser.)

The purpose is to provide a basis for determining the price differentials justified under any given production conditions and the resulting limitations on areas to be supplied from the various producing sections. A study of official statistics on production and prices, freight rates, and other pertinent data. (Unfinished.)

2. Economic Aspects of Local Potato Warehouse Organization. (See abstract under John D. Black.)

EDWIN C. JOHNSON, B.S., Instructor in Agricultural Economics.

Business Practices of Farmers' Local Grain Elevators. (See abstract under H. B. Price.)

GEORGE M. PETERSON, M.A., Instructor in School of Business.

1. Economics of Production. (Thesis for the Ph.D. degree; J. D. Black, Adviser.)

The purpose is to collect and analyze data relating to the principles of production economics. Field studies are made of manufacturing plants, wholesale establishments, etc. The available literature is sifted. (Work in progress.)

2. Economic Aspects of Local Potato Warehouse Organization. (See abstract under J. D. Black.)

ARTHUR R. UPGREN, B.A., Instructor in Economics.

Economic Organization of the Grain Commission Function. (Thesis for the M.A. degree; under the direction of H. B. Price and J. D. Black.)

The purpose is to discover the factors affecting the efficiency of a grain commission firm. These factors will be measured by costs and such other objective standards as can be found. Consideration will be given to conditions affecting variations in efficiency. A detailed study of the business of a grain commission company for one year will be made. (Unfinished.)

CARL C. ZIMMERMAN, M.S., Instructor in Rural Sociology.

Farmers' Marketing Attitudes. (Thesis for the Ph.D. degree; under the direction of J. D. Black and C. J. Galpin.)

The purpose is to discover what farmers know about marketing, what they think about it, and the reasons for both. A field study of 400 farmers and 75 co-operative marketing officials in 9 different areas in Minnesota, supplemented by analysis of pertinent statistical, historical, and other data. (Unfinished.)

CHARLES M. ARTHUR, B.S., Graduate Student.

Business Practices of Farmers' Local Elevators in Minnesota. (See abstract under H. B. Price.)

ROY C. BALLINGER, B.S., Graduate Student.

Distribution of Rent-Charges to Different Land Uses. (Thesis for the M.A. degree; J. D. Black, Adviser.)

The purpose is to develop proper bases for determining rent-charges for land operated under different tenures, or put to different uses. An analysis of research studies and other literature upon the subject. Application of proposed methods to sample data. (Unfinished.)

ALBERT G. BLACK, B.S., Graduate Student.

Methods of Appraisal of Land for Loan Purposes. (Thesis for the M.A. degree; under the direction of J. D. Black and G. W. Dowrie.)

To describe and analyze the methods of appraisal of land now used by the various types of land loan agencies. An analysis of records of loan agencies; interviews; etc.

ANDREW CAIRNS, B.S., Graduate Student.

1. Organization and Management Problems of Wheat Pools. (Thesis for the Ph.D. degree; under the direction of H. B. Price and J. D. Black.)

An analysis of the types of organization used by different wheat pools, special reference being given to methods of selling, development of new markets, prorating price and expense, area of the pool, and wheat-marketing finance. Personal visits to the principal wheat pools in the United States and Canada will be made, and the information thus obtained will be supplemented by data from official reports of grain exchanges, trade papers and the like. (Unpublished.)

2. See also study listed under Agricultural Biochemistry.



OMAR O. CHURCHILL, B.S., Graduate Student.

The Economics of Flax Seed Production in the United States. (Thesis for the Ph.D. degree; J. D. Black, Adviser.)

To determine the economic basis of flax seed growing in the United States, and forecast future trends with respect to the same. An analysis of available data upon production, price, and costs of flax seed and other crops grown in the same area; also foreign production statistics; also geographic influences. (Unfinished.)

G. HERBERT FREDELL, B.S., Graduate Student and Research Assistant.

Organization and Management Problems of a Central Co-operative Butter Selling Agency. (Thesis for the M.A. degree; under the direction of H. B. Price and E. W. Gaumnitz.)

The purpose is to discover the proper type of organization for selling butter co-operatively at the central market and to determine the possible economies and improvement to be realized by this method of marketing. Special attention is given to improvement in quality of product, and methods of selling. A detailed analysis of a large co-operative butter-marketing agency, and the use of general information obtained in local creamery studies. (Unpublished.)

CONRAD H. HAMMAR, B.S., Graduate Student.

Valuation of Cut-Over Land in Minnesota. (Thesis for the M.A. degree; under the direction of J. D. Black and L. C. Gray.)

To determine the value of various classes of land in the cut-over region of Minnesota. Statistical analysis of data obtained in previous surveys made for land settlement studies; also of census and tax commission data. Questionnaire to 2,500 purchasers of cut-over land. (Unfinished.)

JULIUS HENDEL, B.S., Graduate Student.

The Relation of Cash and Future Prices of Wheat. (Thesis for the Ph.D. degree; Holbrook Working, Adviser.)

To determine the factors influencing the premiums of the various grades of wheat over the prevailing option and their probable effect under various conditions, and to provide if possible a basis for reducing the risks of hedging. A statistical study of prices and premiums, analysis of the relation between premiums, chemical and physical characteristics of wheat, supplies, milling and baking technique, methods of selling, and market demand.

FLOYD J. HOSKING, B.S., Graduate Student.

Consumers' Demand for Raisin Bakery Products in Minneapolis. (Thesis for the M.A. degree; under the direction of J. D. Black, Holbrook Working, and J. C. Marquis.)

To determine the influence of income, nationality, race, and other factors on the consumption of raisin bakery products and the effects of advertising of various types on consumption among the various population groups. The study was made through personal interviews with 225 housewives and 60 bakers in various sections of Minneapolis, and analysis of influence of population characteristics and types of advertising on consumption. (Unpublished.)

HUTZEL METZGER, M.S., Research Assistant in Agricultural Economics.

1. Movement of Spring Wheat. (Under the direction of H. B. Price and E. G. Nourse.)

The purpose is to determine the monthly rate of movement of spring wheat through the successive steps in the marketing process (local elevator, terminal ele-

vator, and flour mill) from 1905 to 1923, and to discover the factors affecting the rate of movement. Data were obtained from line elevator companies, flour mills, and from official sources. (Unpublished.)

2. Economic Organization of Local Grain Elevators. (Unpublished thesis for the Ph.D. degree; under the direction of H. B. Price, J. D. Black, and C. L. Christensen.)

The purpose is to determine factors affecting efficiency of elevator operation, such as the effect of volume, combination of grains, storing, and side lines on cost of operation; the most economical type and size elevator to construct, etc. The study includes a survey and audits of fifty elevators; and much supplementary information from insurance agencies, commission firms, construction companies, and data of a general character collected in connection with other local elevator studies.

LAWRENCE I. MYERS, M.S., Graduate Student.

Economics of Spring Wheat Growing in the Spring Wheat Region of the United States. (Thesis for the Ph.D. degree; J. D. Black, Adviser.)

To discover the economic basis of spring wheat as a crop for this area and to forecast future developments. An analysis of production, price, and other relevant data for this area and competing wheat areas. (Unfinished.)

EMIL RAUCHENSTEIN, M.S., Graduate Student.

The Conditions of Supply of Market Milk in the Twin City Area. (Thesis for the Ph.D. degree; under the direction of J. D. Black, H. R. Tolley, and O. C. Stine.)

To determine and evaluate the factors determining the volume of market milk supplied, in this area particularly. A statistical analysis of records of the Twin City Milk Producers Associations, other organizations, and of available official data. (Unfinished.)

ELMER A. REESE, B.S., Research Agent in Marketing.

Consumer Demand for Milk in Minneapolis. (Thesis for the M.A. degree; under the direction of H. B. Price and J. C. Marquis.)

The purpose is to determine the importance of such factors as nativity, race, income, age of individual, quality of milk, and weather on the consumptive demand for milk in Minneapolis. Personal interviews were held with 400 housewives in different sections of Minneapolis and with milk dealers, advertising agencies, welfare leagues, and other agencies engaged or interested in the retail distribution of fluid milk.

BRYAN SMITH, B.S., Graduate Student.

Minnesota Farmers' Incomes. (Thesis for the M.A. degree; under the direction of J. D. Black and W. C. Waite.)

The purpose is to construct indices of gross and net incomes of Minnesota farmers. The study is based upon data from United States Census, Minnesota Census, U.S. Department of Agriculture, etc., supplemented with questionnaire data upon a few points. (Unfinished.)

JOHN J. SCANLON, B.S., Graduate Student.

The Effects of the Dairy Products Tariff. (Thesis for the M.A. degree; J. D. Black, Adviser.)

To discover the effects upon agriculture, particularly in Minnesota, of the present and proposed tariff upon dairy products. An analysis of the literature upon the subject, including recent Tariff Commission report; also of data of prices and production in this and foreign countries. (Unfinished.)

THOMAS G. STITTS, B.S., Graduate Student.

Factors Influencing the Price of Butter. (Thesis for the Ph.D. degree; under the direction of Holbrook Working and O. C. Stine.)

To measure the relation between price and consumption of butter and the influence on this relation of any factors affecting demand; to determine the significance of existing butter statistics and to indicate desirable modifications in the data, if any. A statistical analysis of data and investigation of methods of compilation, characteristics, and possible means of improvement. (Unfinished.)

GEORGE S. SULERUD, B.S., Graduate Student.

Economic Basis of Shifts in Production in the Red River Valley since 1880. (Thesis for the M.A. degree; J. D. Black, Adviser.)

To determine the manner in which farmers shift their production in response to changing prices and costs. An analysis of all available data of production and prices and factors influencing the same. (Unfinished.)

THEODORE SUNDTROM, B.S., Graduate Student (Deceased).

Economic Organization of the Livestock Commission Function. (Thesis for the M.S. degree; under the direction of H. B. Price and J. D. Black.)

The purpose is to discover the factors affecting the economy of operating a livestock commission firm, including the effect of volume of business, combination of different kinds of livestock handled, and different business practices on cost of operation. A detailed study of a large co-operative commission firm at South St. Paul; also a survey of the available literature on the subject. (Unpublished.)

NORMAN WALL, B.A., Graduate Student.

Livestock Credit. (Thesis for the M.A. degree; under the direction of J. D. Black and G. W. Dowrie.)

To determine the adequacy of present credit facilities for livestock production and marketing, and suggest improvements if any are needed. An analysis of records of livestock loan agencies; of such production data as necessary, etc. (Unfinished.)

## AGRICULTURAL ENGINEERING

HARRY B. ROE, B.S. in Eng., Associate Professor of Drainage.

1. Methods and Costs of Drainage Installation and Correlation of Land and Crop Values with Cost of Drainage. Publications: (1) Tile Drainage a Real Source of Profit in Farming (Journal Series, Paper 478, Department of Agriculture, University of Minnesota). *Agricultural Engineering*, 5:75-99, 1924; revised and reprinted in *American Society of Agricultural Engineers Transactions* 17:49-64, 1923; (2) Farm Drainage Methods (Survey and Design). St. Paul. *University of Minnesota Agricultural Experiment Station Bulletin* 216, 1924. 71 pages; (3) Farm Drainage Methods (Construction) St. Paul. *University of Minnesota Agricultural Experiment Station Bulletin* 217, 1924. 44 pages.

This project includes: (1) Collection from actual farm drainage projects installed under the general supervision of the drainage staff of continuous and specific data that will make possible the definite correlation of land and crop values with drainage costs, in different districts of the state according to local economic conditions and types of farming; (2) analysis of drainage costs; (3) a study of methods of drainage installation; and (4) a study of general drainage efficiency.

A mass of material covering a complete analysis of drainage installation costs and including a set of curves of cost of tile trenching based on a man hour labor unit are about ready to be offered for consideration as a bulletin in the Technical Series of the Agricultural Experiment Station.

## 2. Drainage and Water Control Investigations on Peat Lands.

A determination of the relation between ground water supply and crop growth on peat soils; the movement of ground water in peat; and the relation between the water supply in peat and underlying subsoils with a view to establishing principles upon which the drainage of such lands can be based. A complete tile drainage system has been installed on a tract of peat where the height of the ground water can be controlled both in maximum and minimum elevation; on equal plots the ground water is there maintained at depths of 1 foot, 2 feet, 3 feet, 4 feet, and 5 feet; standard field and horticultural crops are planted in strips across all these plots as an actual farm; and the resulting crops at maturity on the different levels are carefully compared. The work is in the early stages and results are not yet available.

## 3. Determination of the Relative Efficiency of Differing Depths and Spacing of Drainage Lines in Different Soil Types.

To determine, by actual and systematic measurement and computation, the angle and rate at which soil-water will reach drainage lines to the end that the greatest efficiency coupled with economy may be attained in the design and installation of drainage systems. The work of the project will eventually cover the entire state with observation taken on all the principal major soil types, probably about twelve in all. Test wells are sunk to or below the grade of the tile lines at frequent intervals across these lines and, for the sake of comparison, out over adjacent undrained land, and regular and systematic measurements are taken of the shape and position of the water table. Check measurements of the total discharge at outlets are also taken in a number of instances. From the data obtained the necessary formulae for the different soil types will be calculated. (Work unfinished.)

EARL A. STEWART, B.Pd., B.S., Associate Professor of Agricultural Physics.

1. Heating and Ventilating of Houses. Publications: (1) Proper Installation of Warm Air Heating. *Agricultural Engineering*, 6:52-57, 1925; (2) Locating the Warm Air Register. *Furnaces and Sheet Metals*, 4:17-19; (3) Return Cold Air Ducts. *Furnaces and Sheet Metals*, 4:13-15; (4) Installing Heating Plants in Old Houses. *Furnaces and Sheet Metals*, 4:29-31.

The purpose of this problem is to determine the air conditions that are secured in a home by the different methods of heating and what methods of heating give the most desirable air conditions. Tests were made on actual installations. Some of the work has been done with the heating plants as installed by commercial firms, and a number of plants of a special design have been installed. The work up to date has been on temperature and humidity conditions only. Odor, dust, bacterial, and chemical conditions will be taken up later. The investigations have dealt largely with types of installation. A more complete study of types of heating units will be taken up in future studies. The results so far indicate that the most desirable temperature and humidity conditions can be secured with a warm air heating system with automatic temperature control. Temperature control equipment is more effective on warm air than on hot water or steam heating systems. The method of installation is more important than the type of furnace in securing good air conditions.

## 2. Farm Sewage Disposal.

The purpose of this project is to determine the operating characteristic of several types of sewage disposal plants and to determine the types which give the most satisfactory operation. Several types of sewage disposal plants were constructed for actual operation for homes, creameries, etc. A study is then made of their operation and



observations are made on their success. The investigation so far shows that much more study must be given to creamery sewage disposal. The problem is difficult to solve in a manner that is acceptable to creameries because of the cost of disposal. Creamery sewage can be handled easily by dilution where streams or lakes of suitable size are accessible. There are a number of conditions surrounding rural homes which offer no obstacle to the efficient disposal of sewage wastes. On the other hand there are conditions which at the present are such as to make satisfactory sewage disposal impossible. Further study is necessary in order to determine means for disposing of sewage where it is impossible to secure deep drainage in clay soil, and where open disposal can not be used.

3. The Utilization of Electricity in Agriculture. Publications: (1) Wiring of Farm Homes and Farmsteads. *Committee on Relation of Electricity to Agriculture Bulletin*, 1, No. 1; (2) Problems on the Utilization of Electricity in Agriculture. *Committee on Relation of Electricity to Agriculture*, Vol. 1, No. 3, pages 10-13. (3) The Minnesota Project. *Committee on Relation of Electricity to Agriculture*, 1, No. 4:1-7; (4) Progress in Rural Service Study, by A. M. Perry, *Electrical World*, 84:1253-58, 1297-1301; (5) The Red Wing Line: Booklet, Minnesota State Committee on Relation of Electricity to Agriculture, St. Paul.

The purpose of this project is to determine the conditions under which a farmer may be given electricity and the conditions under which he may use it to advantage. Eight farms have been equipped with numerous devices and machines for utilizing electricity in the operations of the farm and home. A study is being made of the cost of operation and of the benefits secured by the use of electricity. Records of farm operations are being secured to determine the best methods of using electricity for farm power purposes. The results, thus far, indicate that the average farmer has a sufficient power load that can be handled by electricity so that he can use a large quantity of electricity and its cost will not need to be more than six or seven cents per kilowatt hour. A farmer can not use a large enough amount of electricity for lighting and ordinary household uses so as to get electricity at a very low price. In order to make the electricity earn its cost, the farmer must use it for outdoor and barn power purposes.

HALL B. WHITE, B.S. in Agr., Assistant Professor of Farm Building.

Investigation of Farm Buildings. A bulletin on *Barns* is now in process of publication.

The purpose is to collect data that will enable the farm building section to prepare plans of buildings suitable for the different types of farming such as grain, dairy, beef, general, and special farming as well as to furnish information for the farmers on their farm building problems. The investigation of materials for farm buildings has led to tests of rammed earth and soils suitable for use in such construction, straw and log buildings, crib silos, hollow tile, concrete, and wood and concrete have been examined. Weathering tests of roofing, cold water and oil paints are in progress. The present results show that a number of methods of construction that are given publicity in the popular press are of very doubtful value when durability and satisfaction are considered. Over ten thousand blue prints of plans were distributed last year.

D. G. MILLER, Drainage Engineer.

(With P. C. McGrew and E. J. Bullis.) Farm Drain Tile Investigations. Publications: (1) Laboratory Investigations of the Influence of Curing Conditions and Various Admixtures on the Life of Concrete Stored in Solutions As Indicated by Physical Changes. *American Society Testing*

*Materials Proceedings, 1924.* (2) Curing Conditions of Concrete Drain Tile; a Factor of Resistance to Sulphate Waters. *Concrete*, June, 1924. Several other papers in the course of preparation.

The Department of Agriculture, University of Minnesota, in co-operation with the Department of Drainage and Waters, State of Minnesota, and the Bureau of Public Roads, U.S. Department of Agriculture, is continuing the investigations relative to drain tile at the University Farm, St. Paul, Minnesota.

The work consists primarily of studies having for their object the improvement of the quality of farm drain tile. Special efforts at this time are being made to develop concrete tile that will endure under soil conditions that heretofore have proved detrimental as has been the case with some of the so-called "alkali" soils and some of the peats. Studies are also under way relative to frost action on surface clay tile. About 20,000 experimental cylinders and drain tile have been made to date, many of which have been installed for observation under various field conditions in Minnesota, Wisconsin, and North and South Dakota, all these installations having a direct bearing on conditions as found in Minnesota. Considerable work has been done in the laboratory on the curing of concrete as it has been found that variations in this factor alone exert a very great influence on the behavior of concrete specimens subjected to the action of sulphate waters. So far, one of the outstanding features has been results obtained by curing concrete in steam in a temperature near 212° F.

## AGRONOMY

ALBERT C. ARNY, M.S., Associate Professor of Agronomy.

(With F. W. McGinnis.) Relative Value of Biennial White, Biennial Yellow, and Biennial White Sweet Clovers. *Journal of the American Society of Agronomy*, 16:384-96.

The purpose is to show yields and quality of hay as well as root residues and their effect on soil fertility. The annual white variety yielded 15 per cent more dry matter in the tops than the biennial white and 35 per cent more than the biennial yellow variety. The percentages of proteins in the tops of the three varieties were approximately equal. The annual white variety yielded lower in root production than the biennials. The percentage of protein in the annual white sweet clover roots was 8.44 and the biennial is 18.34. The total production of protein in the tops and roots was 55 per cent greater in the biennial white and 61 per cent greater in the biennial yellow sweet clovers than in the annual white variety.

FORREST W. MCGINNIS, M.S., Assistant Professor of Agronomy.

### 1. Investigations with Sugar Beets.

The purpose of this research (begun in 1925) is to determine most desirable varieties for tonnage and sugar content as affected by date of planting, spacing of rows, and blocking at different intervals. Other phases studied include: (a) strong and weak plants performance; (b) resistance to frost at progressive stages of development in the spring; (c) effect of loss of foliage by disease on sugar percentage; (d) response of sugar beets to different fertilizer treatment and water levels on peat soils; (e) loss or gain in sugar recovery in different methods of harvesting; (f) effect of the sugar beet crop on those which succeed it in the rotation plan.

### 2. Development of the Wheat Kernel As Influenced by Soil Fertility.

The purpose of this investigation (begun in 1922) is to show whether the protein percentage of wheat is influenced by the increased soil fertility gained in rotation of crops. The daily development of the kernel was followed from fertility to maturity on soils wheat continuously, wheat following clover, wheat following timothy, and wheat to which sodium nitrate had been added. While the percentage was not greatly

increased following clover or with nitrogenous fertilizers, the pounds of protein recovered and the total yield were increased 100 per cent or more.

### 3. Water Level Controls on Peat Soils.

The purpose of this study (begun in 1924) is to show the effect of establishing a drainage system in peat soils at different levels on all farm crops adapted to peat soils. The water control levels are established from 1 to 6 feet.

### 4. Sugar Beets in Minnesota. *University of Minnesota Agricultural Experiment Station Special Bulletin*. 90. 1924. 12 pages.

This publication describes the technique of sugar beet production with statistics and the cost of production.

### 5. Relative Value of Biennial White, Biennial Yellow, and Biennial White Sweet Clovers. (See abstract under A. C. Arny.)

## ANIMAL HUSBANDRY

EVAN F. FERRIN, M.Agr., Professor of Animal Husbandry.

### 1. Methods of Feeding Rye to Growing Pigs.

The purpose is to determine if possible the deficiency in the ration when rye constitutes the principal grain fed to growing pigs. Forty pigs farrowed during the month of September, 1924, were fed in lots of ten each. In planning this particular trial, which is one of a series, the objects were to supplement the rye grain in several ways in order to gain information concerning the cause of the unsatisfactory results previously noted. Care was taken to prevent the pigs from consuming earth or any other foreign material. A salt mixture consisting of equal parts of bonemeal, charcoal, air slaked lime, marl, and sodium chloride was supplied each lot in such quantities as the appetite required.

Normal growth has not been secured on any of the four different rations fed. The highest gain, 0.71 pounds daily per pig, resulted from the feeding of ground rye and the protein supplement mixture. This rate of growth is only 51 per cent of normal expectation. The rations of ground rye plus casein and ground rye plus tankage and cod liver oil both gave low gains; the rates being 0.59 and 0.63 pounds daily per pig. More work must be done before a determination of the deficiencies of the rye grain will be possible.

### 2. See also the study with M. A. McCarty.

MARK A. MCCARTY, B.S., M.S., Assistant Professor of Animal Husbandry.

(With E. F. Ferrin.) A Comparison of the Feed Requirements, Rate, and Cost of Gains of Fall and Spring Pigs. *University of Minnesota Agricultural Experiment Station Bulletin* 213, 1924. 16 pages. (Thesis for the M.S. degree.)

One hundred eighty pigs in 18 groups of 10 pigs each were fed during a two-year period (1921-22). Sixty of these were fall farrowed, 120 were spring pigs. As a result of this investigation it was shown that: (1) there is no significant difference in the feed requirement of spring and fall pigs when similarly cared for and fed; (2) the rate of gain of fall and spring pigs under like conditions except for season is practically identical; (3) fall pigs make cheaper gains than spring pigs because feed costs are lower for fall pigs; (4) fall pigs when finished for market sell at a higher average price than do spring pigs; (5) pasture cheapened the costs of gains, lowered the feed required to produce gains, and reduced the amount of protein supplement required in the ration; (6) the results of the comparison indicate that greater emphasis may well be given to fall pig production in Minnesota.

LOUIS VINKE, B.S., Graduate Student.

The Fattening of Calves for Baby Beef with Special Reference to the Value of Corn and Cob Meal. (Thesis for the M.S. degree; under the direction of W. H. Peters and H. W. Vaughan.)

Thirty Angus steer calves were fed in two lots of ten each and two lots of five each. In planning this trial the objects were not only to feed corn and cob meal in comparison with shelled corn, but to feed the cobs separately from the corn in one lot to determine whether the value of cobs is due to a better physical mixture produced, and to determine whether another cheap roughage such as oat straw could replace the cob. The feeding of corn and cob meal in comparison with shelled corn showed that the former feed resulted in less grain requirement per pound gain without the sacrifice of much finish, and with a greater profit per head. In this trial 2.66 pounds of cob replaced one pound of corn. The value of corn and cob meal was not due to a better physical mixture produced, and was not due to the added bulk of the ration. The beneficial results of the cob are due to the nutritive value of the cob.

## DAIRY HUSBANDRY

CLARENCE H. ECKLES, M.S.A., D.Sc., Professor of Dairy Husbandry and Chief of the Division.

1. (With Vernon Williams.) Yeast As a Supplementary Feed for Lactating Cows. *Journal of Dairy Science*, 8:89-93. 1925.

Commercial yeast was fed to 8 cows over periods of 60 days at the rate of 25 grams per pound of milk produced as a supplement to ordinary rations. No increase in milk production was observed and no effect noticeable upon the condition or appetite of the animals. The conclusion is drawn that ordinary rations used in practice supply a sufficient quantity of vitamin B for milk production.

2. (With T. W. Gullickson.) Raising the Calf When Whole Milk Is Sold. *University of Minnesota Agricultural Experiment Station Bulletin* 215. 1924. 30 pages.

Eighteen calves were raised on the minimum amount of milk, and the rate of growth, both in skeleton and in weight, measured by comparison with the normal. These experiments show it is possible to raise calves satisfactorily with no milk after the age of 70 days. Powdered skim milk and dried buttermilk were also used successfully as a substitute for milk after the age of 20 days.

3. (With Vernon Williams and John Wilbur, in co-operation with L. S. Palmer and H. M. Harshaw.) Yeast As a Supplementary Feed for Calves. *Journal of Dairy Science*, 7:421-39. 1924.

Six groups of calves were used, including forty-eight individuals. Yeast was added from birth to six months of age, to typical rations as used in practice and to rations representing more extreme conditions than ordinarily used. The rations used including the yeast were checked by feeding tests with rats. The addition of vitamin B in the form of dried yeast to rations ordinarily fed on dairy farms did not increase the rate of growth in calves. No definite effect was observed on the health of the animals used.

4. (With W. B. Combs.) The Control of the Composition of Butter.

A study of the composition of butter as manufactured in Minnesota, and of methods for better standardization. A total of 3,400 analyses are available, representing the product of over 600 creameries. The lack of standardization in the product at the time this project was begun resulted in losses running into millions annually. Results of this study and of methods of control made available to creamery operators



as the investigation progressed, have already been responsible for a decided improvement in the composition of butter made in Minnesota.

5. (With T. W. Gullickson.) The Deficiencies of Milk As an Exclusive Diet for Calves.

An exclusive diet of whole milk has been found to result in death of the calf within four months. Various supplements have been added to the rations of fifteen calves, including vitamins, and various minerals. Supplements supplying liberal quantities of vitamins A, B, and C give negative results. The addition of calcium prevents tetany and prolongs the life of the animal to eight or nine months but does not make the ration adequate for normal development beyond this age.

6. (With T. W. Gullickson in co-operation with L. S. Palmer.) The Deficiency in the Ration Fed Cows in Western Minnesota.

Serious conditions occur among cattle over a large area as the result of an inadequate diet. Data have been accumulated by surveys of regions affected, by analyses of water, and by feeding tests. The results indicate the deficiency is either calcium or phosphorus. Tests on a large scale in the regions affected show the feeding of bone meal prevents the trouble from developing.

7. See also the studies by S. E. Bechdel, R. B. Becker, C. D. Grinnells, I. R. Jones, K. S. Morrow, H. R. Searles, and L. M. Thurston.

WILLES B. COMBS, M.A., Professor of Dairy Husbandry.

The Control of the Composition of Butter. (See abstract under C. H. Eckles.) See also two additional projects listed under Harold Macy.

THOR W. GULLICKSON, B.S., Assistant Professor of Dairy Husbandry.

1. (With C. H. Eckles.) The Energy Requirements for Normal Growth of Dairy Animals.

This investigation to determine the energy requirements for normal growth of dairy animals during the first two years has been under way for several years. Different methods of attacking the problem have been followed. Some animals have been fed a certain percentage of their energy requirements calculated by the Armsby standard and the resulting growth determined and compared with the normal growth of animals of similar age. Other animals have been so fed as to follow the normal growth curve and the energy supplied the feed determined. The length of the periods over which the studies have been made have varied from fifty days to about one and one-half years. The ages of the animals range from birth to about two years. The data available indicate that Armsby's standard as applied to calves under six months of age is probably too low, but at older ages it appears that normal growth can be obtained with considerably less than the amount called for in his standard, 85 per cent or even less of his requirements apparently being sufficient to maintain normal growth.

2. (With C. H. Eckles.) The Energy Requirements for Maintenance of Dairy Animals.

This investigation is part of a study of the energy requirements for normal growth. The work has been under way for one year and nine animals, ranging in age from three to ten months, have as yet been used. Two plans of pursuing the study have been followed: (1) feeding 100 per cent of the energy requirements for maintenance according to the Armsby standard over periods of several months, and securing daily weights and adjusting rations at regular intervals; (2) providing a low fixed ration during experimental periods ranging from 30 to 50 days in length and securing daily weights. The data now on hand are too limited to draw any definite conclusions,

but the results indicate that the energy requirements for maintenance as set forth by the Armsby standard for animals weighing less than 450 or 500 pounds are too high.

3. Three additional projects are listed under C. H. Eckles.

HAROLD MACY, B.S., Assistant Professor of Dairy Bacteriology.

1. (With W. B. Combs and L. M. Thurston.) A Study of Mold in Relation to the Quality of Butter.

A study has been made of some of the factors influencing the mold content of butter and the appearance of mold on storage butter. Methods for treating parchment have already been devised and put into practice. The location and elimination of contamination in the creameries have been demonstrated. Further investigations to discover sources of mold in butter and to devise methods for control are being pursued. The factors which favor the development of moldiness in butter are also receiving attention.

2. (With W. B. Combs and L. M. Thurston.) Cheesiness in Butter.

Attempts have been made to discover the causes of some of the cheesy flavors and odors which cause extensive market losses. In two cases the butter possessed an aroma of limburger cheese. Two different organisms were isolated. These organisms when inoculated into sterile cream were able to reproduce the typical odor. The organisms are being classified and identified. The possible sources of these bacteria and the factors influencing the control of this serious defect of butter are being investigated.

3. A Preliminary Study of the Bacterial Content of Powdered Milk Obtained on the Open Market.

A considerable number of foreign and domestic samples of powdered milk purchased on the market have been examined. The powder made by the spray process was, as a rule, much higher in bacterial content than that made by the drum process. As a whole, the foreign samples gave a higher count than the comparable domestic samples. During storage the total number of bacteria in any given sample decreased decidedly; most at 37° C., less at 20° C., and least at 10° C. Certain samples have been examined at intervals over a period of four years. Milk powder, reconstituted with sterile water shows, in the majority of cases, an acid peptonizing type of fermentation at ordinary temperatures of handling and storage.

WILLIAM E. PETERSON, M.S., Assistant Professor of Dairy Husbandry.

1. Adulterated Acid As a Possible Source of Error in Testing Milk by the Babcock Method. *Journal of Dairy Science*, 7:361-69. 1924.

It was found possible to adulterate sulfuric acid with combination of various fats and fat solvents so as to give higher fat reading of the Babcock test of milk where such acid was used. Saturated solutions of butterfat in gasoline, benzine, or xylol when added to cold sulfuric acid did not alter the appearance of the acid and remained dispersed in the acid for an hour or more after being thoroughly mixed. This makes possible fraudulent practices in connection with official testing where the breeder has chances for making such adulterations. Means are pointed out for detecting errors due to this cause.

2. A Study of the Immediate Effect of Feeds High in Fat upon the Quantity and Quality of Cow's Milk.

A study of the effect of ground flax upon the amount of milk and its fat content on seventeen cows over a period of a year has been completed and the effects of ground soybeans are now being studied. The immediate effect of ground flax varied with different individuals. Some individuals increased both the amounts of milk and its fat percentage the day after the flax was fed; others increased only the amount of milk or the fat percentage and still others showed no effect in either amounts of milk or its fat percentage. Cows that responded to the feeding of ground flax by either increasing the amount or fat percentage of the milk or both were uniform in the degree of response at the various times that the tests were made.

SAMUEL E. BECHDEL, M.S., Graduate Student.

The Vitamin B Requirement of the Growing Calf. (Thesis for the Ph.D. degree; C. H. Eckles and L. S. Palmer, Advisers.)

Calves have been fed from birth to the age of eighteen months on rations deficient in vitamin B, but adequate in other respects. Comparisons have been made with check animals receiving the same ration plus the vitamin B. One group of animals used were the offspring of cows maintained on a ration deficient in vitamin B for three months previous to the birth of the young for the purpose of removing the possibilities of a vitamin storage in the calf. All feeds used have been tested for vitamin potency by extensive feeding experiments with rats. The results are practically negative. The conclusion is that either the bovine does not require any appreciable quantities of vitamin B, or it is produced by the bacterial flora of the alimentary tract.

RAYMOND B. BECKER, M.S., Graduate Student.

1. Calculating the Average Production of a Dairy Herd. *Journal of Dairy Science*, 8:105-14. 1925.

A comparison of six methods which are in common use for calculating the average production of dairy herds. It was concluded that there should be one uniform method employed in such calculations. The inaccuracies of certain methods are pointed out.

2. Studies on Mineral Deficiency in Rations Fed Cattle. (Thesis for the Ph.D. degree; C. H. Eckles and L. S. Palmer, Advisers.)

Cattle showing typical symptoms of mineral deficiency have been brought from affected regions together with feeds grown on the same farms. Mineral supplements have been fed with these rations. It has been found possible to prevent and to cure the trouble with animals under controlled conditions. Analyses were made of a series of milk samples taken from cows suffering from pronounced cases of mineral deficiencies. Samples of bones from badly affected animals will also be analyzed. Results so far indicate no change in the mineral composition of milk when the mineral deficiency in the ration is extreme and long continued. Feeding tests point to phosphorus as the deficient element in the feed grown in these regions where the trouble occurs.

FRANK BELE, B.S., Undergraduate Student.

Cerelose As a Sweetener in Ice Cream. (W. B. Combs, Adviser.)

Investigations are under way to determine the value of cerelose as a sweetener for commercial ice cream. Work completed shows that when cerelose is used as a sole sweetener the ice cream is not relished in other proportions exceeding 40 per cent. Other details, such as the effect of cerelose on the body and the texture of ice cream, heat resistance, freezing point, length of time of freezing, are being investigated.

CLAUDE D. GRINNELLS, B.S., Graduate Student.

Factors Influencing the Breeding Efficiency of Dairy Cows. (Thesis for the M.S. degree; C. H. Eckles, Adviser.)

A study, largely statistical in character, based on the records of the University herd for twenty-five years, also records from other herds including highly developed and ordinary herds. Factors studied are influence of age of male and female, diet, abortion, plane of milk production. In progress, results not yet available.

IDWAL R. JONES, M.S., Graduate Student.

The Vitamin A Requirement of the Growing Calf. (Thesis for the Ph.D. degree; C. H. Eckles and L. S. Palmer, Advisers.)

Calves have been fed from birth on rations deficient in vitamin A but adequate in other respects. Comparisons have been made to check groups receiving the same ration with the addition of vitamin A. All feeds have been tested for vitamin A content by the use of rats. The results are positive. Calves on a ration free from vitamin A show characteristic symptoms within two months and survive only to the age of three months. Wheat straw has been found to contain a fair amount of the vitamin in question.

HERBERT C. MOORE, B.S., Graduate Student.

The Relation between the Gold Number and Various Methods of Measuring the Protectiveness of Gelatin. (Thesis for the M.S. degree; W. B. Combs, Adviser.)

The gold number, often used by the chemist in measuring the protective property of colloids, was found to be of no value in the selection of gelatin for use in manufacturing ice cream. After studying the chief characteristics of six commercial gelatins it was concluded that the effect of gelatin on the standing up qualities or melting resistance, body and texture and flavor of the finished ice cream are the best indexes of the grade and amount of gelatin to use in the ice cream mix.

KENNETH S. MORROW, B.S., Graduate Student.

Soybeans As a Source of Protein for Dairy Cows. (Thesis for the M.S. degree; C. H. Eckles, Adviser.)

Soybean hay has been tried as a source of protein in comparison to protein from other sources. The results indicate soybean forage to be an economic and satisfactory feed for this purpose.

HAROLD R. SEARLES, B.S., Dairy Specialist.

Sweet Clover As a Feed for Cattle. (Thesis for the M.S. degree; C. H. Eckles, Adviser.)

Information is being gathered from farmers by questionnaire and personal visits. Experiments are under way using this plant for silage and as a hay for cattle.

LLOYD M. THURSTON, B.S., Graduate Student.

1. The Vitamin C Requirement of the Growing Calf. (Thesis for the Ph.D. degree; C. H. Eckles and L. S. Palmer, Advisers.)

Two groups of calves have been fed from the age of two weeks to one year with rations practically free from vitamin C. Vitamin C was destroyed in the milk fed by heating to 82° C. for an hour with oxygen bubbling through the liquid. All feeds used were tested for vitamin C potency by feeding tests with guinea pigs. The results show that the calves make a normal growth to the age of one year and appeared to be in a perfectly normal condition on a ration so low in vitamin C that guinea pigs receiving it died of scurvy inside of twenty days. No indications of conditions suggesting scurvy could be detected in the calves used.

2. See two additional studies listed under Harold Macy.



## ENTOMOLOGY AND ECONOMIC ZOOLOGY

WILLIAM A. RILEY, Ph.D., Professor of Entomology and Chief of the Division of Entomology.

1. (With H. C. Kernkamp.) Flukes of the Genus *Collyriclum* As Parasites of Poultry.

A peculiar parasitic flat worm or fluke has long been known as a rare parasite of song birds, but has never been known to infect domesticated birds. Recently it has been found to occur in nearly 50 per cent of a large flock of chickens and almost equally in a flock of turkeys 150 miles removed from the chickens. These constitute the only records of this worm affecting poultry. The evidence indicates that like typical flukes, it undergoes an essential part of its life cycle in the water. Data as to the exact method of transfer to birds are being sought.

2. (With Carl Ostrom.) Studies on the Fox Hookworm, *Uncinaria polaris*.

This hookworm is one of the most widespread and serious of the helminth parasites of foxes. In some 300 examinations it was found to be present in 33 per cent. On some ranches practically 100 per cent of the foxes were infected. It is often the cause of heavy loss of pups. The fox pups may be infected very early in life, chiefly through contaminated soil in the dens. There is some evidence of prenatal infection though the reported cases are vitiated by the fact that they deal with pups over two weeks of age while our experiments show that the worms may develop to maturity in as brief a period as fourteen days. *Uncinaria polaris* is readily transmissible to dogs and cats. In fact our studies support Ransom's contention that this species is identical with *U. stephanocephala*, a known hookworm of dogs. These animals, then, may serve as reservoirs for the parasite.

3. The Animal Parasites of Pheasants.

During the past year much interest was aroused by reports from hunters and the newspapers to the effect that pheasants were being killed in great numbers by some parasitic disease. Numerous examinations of birds found dead, or shot for study were made and it was definitely established that in these particular cases there was no unusual parasitism. Of the birds found dead practically all showed evidence of mechanical injury. Since parasitic diseases may occur, studies are being continued as opportunity arises.

4. See also the studies listed under M. Joannides, Department of Surgery; and under C. Leist, C. E. Mickel, C. B. Philip, E. W. Stafford, H. E. Wallace, and G. Dikmans, Departments of Entomology and of Animal Biology.

ROYAL N. CHAPMAN, Ph.D., Professor of Entomology.

1. (With J. R. Parker, C. E. Mickel, E. G. Kelley, and G. E. Miller.) Studies in the Ecology of Sand Dune Insects.

Small sand dune areas are to be found in Minnesota with environmental conditions very similar to those of the great desert areas. A knowledge of these areas would be of value in interpreting the importance of temperature in environments. Records were made of the fluctuations of temperature through the summer and it was found that the surface of the sand frequently reached 50° to 60° C. (122° to 140° F). The relative humidity was found to vary from 80 to 100 per cent, at night, to 25 per cent during the day. It was found that the fauna of the night left the surface of the sand and dug down below the surface and that the fauna of the day

appeared after sunrise. The effect of temperature on the various species was measured and it was found that it was necessary for even the most characteristic sand dune insects to adjust themselves in time and space in order to endure the high temperatures which obtain. Species from the forest were unable to endure the high temperatures of the dune for more than a few minutes.

2. (With Robert Leicht.) A Quantitative Study of Fresh Water and Marine Planktons.

To determine and compare the productivity of various bodies of water. Since the plankton organisms are the ultimate source of food for the higher aquatic organisms, including the fish, a quantitative measure which will lend itself to comparison of various types of aquatic environments would be valuable both for a better understanding of aquatic ecology and as a basis for agriculture. The plankton is removed from the water by the use of a Sharpless Super-centrifuge. It is then evaporated, weighed, and analyzed for nitrogen content. Work is in progress.

3. See also the studies by W. Carter, N. M. Payne, A. L. Strand, F. Himenkamp, and W. Robinson.

ARTHUR G. RUGGLES, M.A., Professor of Entomology.

1. Combating Injurious Insects of the Orchard.

The trial and error method is used with the ordinary spray materials on the market. The newer insecticides are checked against our standard recommendations in a commercial orchard given by a grower for the purpose. Up to the present time no insects new to the orchard have been detected, but the majority of forms found in the orchard regions are present and doing damage in Minnesota. As far as control is concerned, the principal experiment has been in comparing dusts with liquid sprays. To date the results favor the recommended liquid spray of the combined lime sulphur and arsenate of lead.

2. Life History and Injury Due to *Empoasca mali*.

The purpose is to determine accurately the seasonal history and the rôle of the insect in spreading "hopper burn" of potatoes; also to determine the best method of controlling the insect. The methods used are the rearing of leaf hoppers in cages in the field and greenhouse, checking up by field observation, following the insect in its activities through the entire year. The potato fields are sprayed (in co-operation with the Division of Plant Pathology) with various materials and the results noted on the retarding of the insect injury and on the crop yields. It has been proved that there are two full generations of the potato leaf hopper in Minnesota every season, that the insects hibernate as adults, and that the nymphs are the principal cause of injury. Of the many combinations of spraying materials used to date the ordinary bordeaux mixture (4-4-50) applied at 200 pounds pressure, three nozzles to the row gives the best control.

FREDERIC L. WASHBURN, M.A., Professor of Economic Zoology.

(With C. E. Mickel.) A Test of the Effectiveness of Calcium Cyanide in Poisoning the Pocket Gopher. *University of Minnesota Agricultural Experiment Station Technical Bulletin 27*. 1925. 14 pages.

A large number of gopher burrows were treated with flake calcium cyanide and some with dust calcium cyanide to test its effectiveness in killing pocket gophers and to corroborate or contradict testimonies of other workers in this connection. The results indicated that this material is not effective or practical in this connection and the treatment is far more expensive than poisoned bait.

SAMUEL A. GRAHAM, Ph.D., Assistant Professor of Entomology.

1. Ecological Studies of Log Insects. The Felled Tree As an Ecological Unit. *Ecology*. (In press.)

By placing a large number of freshly cut logs under controlled environmental conditions and recording the occurrence of insects in the different logs it has been possible to determine the effect of the environment on the activities of log insects.

The log is an ecological unit with a distinctly characteristic and well-adapted population. There is a definite succession of organisms in the log as the chemical and physical character of the wood changes during the process of distintegration and decay. In this paper only the xylophagous stage is considered. The primary organisms of the xylophagous stage are those that are able to digest and assimilate the food material available in a green log, and they grade into the second stage which is dependent upon the primary organisms to modify the food materials for their use. The distribution of insects in logs is regulated by many factors of which food, moisture, and temperature appear on the average most important. On the basis of food requirements log insects may be grouped as cambium, cambium-wood, wood, and bark dwellers. Along with insects that are typical of each region of the log are fungi that are equally typical of the parts where they occur. In some cases, as with the ambrosia beetles, there is a close symbiotic relationship between insects and fungi. In other instances there exists a looser type of symbiosis.

2. Spruce Budworm Infestation in Balsam and Spruce.

The purpose is to determine the area infested, and the influence of forest composition upon the severity of the infestation in different localities. The aim in mind is to develop methods of silviculture that will reduce the danger of future outbreaks of this pest. A survey was made by means of sample plots distributed over the infested area. The work is carried on in co-operation with the Bureau of Entomology, U.S. Department of Agriculture.

The outbreak in Minnesota started simultaneously in Koochiching, St. Louis, and Lake counties and somewhat later in Cook County. As a result of this outbreak over 75 per cent of the balsam fir in the infested region and in certain localities over 50 per cent of the white spruce has been killed. Some upland black spruce also has suffered. The intensity of the infestation appears to vary directly with the proportion of balsam fir in the forest.

3. Investigations of Jack Pine Defoliators. Preliminary publication: Two Dangerous Defoliators of Jack Pine. *Journal of Economic Entomology*, 18:337-43.

This investigation involves: (1) intensive studies concerning the life history and reactions of the insects to various environmental conditions and the effects of defoliation upon the trees; (2) more extensive investigations on sample plots distributed over the infested region.

Jack pine, *Pinus banksiana* once regarded as a weed tree, is now becoming a valuable timber species. In the past this tree has been considered almost immune to insect injury but recently it is suffering from the attack of several defoliators. This paper is a preliminary report of co-operative projects concerning two of these defoliators, the jack pine sawfly, *Neodiprion banksiana* sp., and the spruce budworm, *Archips fumiferana* on jack pine. The study is being conducted jointly by the Bureau of Entomology, United States Department of Agriculture and the Minnesota Agricultural Experiment Station.

Climatic conditions influence the abundance of these defoliators but they are not of sufficient importance to explain the present outbreak. Neither is there evidence that the outbreak has been made possible by a lack of parasites and predators. As a result of lumbering and fires the quantity of jack pine forest has been tremendously

increased thus making food conditions especially favorable for jack pine insects. This appears to be a very important factor in making possible this outbreak. Studies of control are still in progress.

CLARENCE E. MICKEL, Ph.D., Assistant Professor of Entomology.

1. Notes on *Zygocystis cometa* Stein, a Gregarine Parasite of Earthworms. (W. A. Riley, Adviser.)

For instructional purposes, one of the most significant groups for the study of the parasitic Sporozoa is afforded by the gregarines infesting the seminal vesicles of the earthworms. The most generally used of these forms are various species of *Monocystis*, which are very widely distributed and usually very abundant, though apparently uncommon in Minnesota.

In order to determine the distribution, prevalence, and seasonal periodicity, the three species of earthworms common locally were examined over a period of two years. In the course of this study, no specimens of *Monocystis* were found. On the other hand, the worm *Helodrilus caliginosus* was almost uniformly infested by a closely related gregarine, *Zygocystis cometa*. The worms were examined every month in the year. Regardless of the time of year, or the source of the worms, those which possessed a well-developed clitellum were always infected. Usually, all stages of the parasite were present, even in the dead of winter.

2. Biological and Taxonomic Investigations on the Mutillid Wasps (Hymenoptera). (Thesis for the Ph.D. degree; O. W. Oestlund, Adviser.)

WALTER CARTER, M.S., Assistant in Entomology.

A Study of the Relationship of Environmental Conditions to the Sugar Beet Leaf Hopper. (R. N. Chapman, Adviser.)

The purpose of this investigation is to determine what factors may influence these insects to leave their native food plants and concentrate on the sugar beets. The measurement of environmental factors is a major part of the problem. A photolino-graph is being used to measure and record light intensity through a Goldberg wedge. Moisture is being measured by atmometers, hygrometers, and psychrometers. The moisture content and osmotic concentration of the food plants are also being studied.

NELLIE M. PAYNE, Ph.D., Assistant in Entomology.

Freezing and Survival of Insects at Low Temperature. (R. N. Chapman, Adviser.)

Three ecological groups of insects have been chosen for this study: (1) aquatic insects which are never exposed to temperatures lower than 0 degrees C., (2) certain species which are pests of stored food products and which are apparently of tropical origin, and (3) certain oak borers which live under the bark of dead and dying oak trees and which are consequently exposed to great extremes of temperature. The freezing points have been determined at the various seasons of the year by means of the thermo-couple method. The insects have also been placed in a low temperature cabinet and exposed to low temperatures for various periods in order to determine the survival times.

It has been found that the aquatic insects have high freezing points which do not vary during the year. The stored product insects are also constantly high in their freezing points. The oak borers, however, lower their freezing and undercooling temperatures during the fall and raise them in the spring. During the winter it is possible for the oak borers to endure the freezing of their body lymph. The bark of the trees has been shown to offer a slight amount of insulation from the cold especially in the case of sudden drops of temperature. However, cold periods late in the spring may cause high mortality among the oak borers.



CORNELIUS B. PHILIP, M.S., Assistant in Entomology.

A Taxonomical and Biological Study of the Tabanidae of Minnesota. (Thesis for the M.S. degree; W. A. Riley, Adviser.)

In parts of Minnesota the *Tabanidae*, or horseflies, constitute a veritable scourge of horses and cattle and directly handicap farm and dairying operations. The immediate object of this study is to ascertain definitely what species occur in the state, and their relative importance, and to initiate a study of their biologies with a view to developing methods of control. Of the forty-two species of the genera *Chrysops* and *Tabanus* found in Minnesota, eighteen have been reared from the immature stages, collected in their natural habitat. Mating of adults under experimental conditions proved unsuccessful. No complete life cycles have as yet been obtained.

A number of parasitic and predaceous enemies of *Tabanids* in Minnesota were noted. Of the former the most important were hymenopterous parasites of the eggs. Proctotrypids of the genus *Phanurus* were the most abundantly reared. Of the bird predators the shore birds, notably Wilson's snipe, the black bellied plover, and the greater yellow-legs are important enemies of the larval stages.

AUGUST L. STRAND, B.S., Assistant in Entomology.

1. A Comparison of Carbon Tetrachloride, Carbon Disulphide, and Chlorpicrin As to Toxicity to Insects and Diffusion in a Column of Grain. (Thesis for the M.S. degree; R. N. Chapman, Adviser.)

This work comprises (a) an investigation of the toxicities of the above mentioned chemicals to the confused flour beetle, *Tribolium confusum*, at different constant temperatures from 10 degrees C. to 35 degrees C.; and (b) an attempt to measure the concentration of these chemicals at different levels in a column of grain during the first twenty-four hours after they are applied to the surface of the grain.

## 2. Use of Chlorpicrin As a Mill Fumigant.

The purpose of this project has been to determine if chlorpicrin can be used to control localized infestation of flour-mill insects in order totally or partially to supplant general fumigations with hydrocyanic acid gas. A method has been perfected by which a mixture of chlorpicrin and carbon tetrachloride can be atomized into the mill machinery and done so conveniently and economically that such fumigations can be carried out at regular intervals. Two things are accomplished by such a system: First, infestations are not allowed to reach an intolerable stage as in the case where general fumigations with cyanide are resorted to; and second, if chlorpicrin is used at short intervals the expense of cleaning the machinery and the shut-down of the mill coincident therewith is greatly reduced.

## 3. Use of Chlorpicrin As a Control for Clothes Moths in Upholstered Furniture.

The great popularity of mohair covered furniture during the past several years brought up the problem of controlling the larvae of clothes moths which commonly infest such furniture. The mohair, or goat hair, itself, is merely the plush or nap which is woven into a cotton foundation. The larvae of the web-spinning clothes moth, *Tineola biselliella*, live just beneath the fabric and eat the mohair threads where they are brought through and around the cotton threads. This allows the nap to fall off and an expensive set of furniture may be badly damaged in a short time. As the larvae are beneath the fabric and protected by it, a fumigant was necessary which would penetrate to them. Chlorpicrin was found to meet the requirements. However, due to the fact that chlorpicrin is very irritating to the eyes and the membranes of the respiratory tract the chief problem connected with its use for this purpose was to discover a satisfactory means of applying it. Of seven principal methods which were tried out, the use of small atomizing sprayers properly located and operated by a tank of compressed air placed outside the fumigation room was found to be most practicable.

#### 4. Use of Chlorpicrin As a General House Fumigant.

For many years the best remedy for the common insect pests of the household has been fumigation with hydrocyanic acid gas. However, the danger of handling cyanide, the time required to prepare for a fumigation as well as the time required for cleaning up after one, and the fact that it does not kill the eggs of many insects have been its conspicuous disadvantages. Consequently, chlorpicrin has been given a trial in two experimental fumigations. The material was put in small atomizing sprayers and the sprayers distributed in the various rooms. The confused flour beetle, *Tribolium confusum*, an insect which is very resistant to fumigants, was used as a check in each room. All were dead when examined after the house was opened up. Clothes moths, *Tineola biselliella*, adults and larvae, and the black carpet beetle, *Attagenus piceus*, the larvae of which occurred in good numbers in the cracks of the floor, were killed.

HUGH E. WALLACE, B.S., Assistant in Animal Biology.

Animal Parasites of the Blattidae. (Thesis for the M.A. degree; W. A. Riley, Adviser.)

The present study brings together the widely scattered work dealing with the topic and includes a detailed study of the fauna of *Blattella germanica*, *Blatta orientalis*, and *Periplaneta orientalis*, the three species of cockroaches most commonly found in houses in Minnesota. In this study of local forms intestinal amoebae, flagellates, ciliates and gregarines, and several species of nematodes have been found. The problem has a practical bearing because there is evidence that the cockroach may transmit, though rarely, certain animal parasites of man. Moreover, it has been found to be the intermediate host of a nematode worm which causes cancer of the stomach in rats, a finding of much interest in the study of this disease.

GERALD DIKMANS, B.S., D.V.M., Graduate Student.

The Hookworms of the Pig and Their Possible Relation to Human Infections. (W. A. Riley, Adviser.)

From various parts of the world have come reports of the occurrence of one or the other of the common hookworms of man occurring in the pig. If these are correct, the pig may play an important rôle in the dissemination of human infections. Available data are very conflicting, some workers insisting that the hookworms of the pig constitute distinct species not transferable to man. Studies of the morphology, biology, the methods of infection, and of isolating the infective stages of various species of hookworms have been made. The more detailed experimental work is being continued in Porto Rico, as a graduate thesis problem.

FRIEDA HIMENKAMP, Undergraduate Student.

A Study of Dormancy and Freezing Points of Certain Dermestid Beetles. (Under the direction of R. N. Chapman.)

These beetles endure long periods at normal temperatures without food and also endure low temperatures. When exposed to low temperature they may endure freezing. This endurance of adverse conditions is of interest from the viewpoint of ecology as it may offer an opportunity to determine the fundamental processes involved in such phenomena. It is of economic interest because these beetles are pests of certain food materials which might be stored under conditions which would make it impossible for the beetles to live, if their limits of toleration were known. Beetles are being kept under various conditions as to food and temperature. Their freezing-points and survival times are being recorded. At the conclusion of a series of experiments it is hoped to find the limits of their toleration.

WILLIAM ROBINSON, M.S., Graduate Student.

Some Effects of Low Temperature on Grain Weevils. (R. N. Chapman, Adviser.)

If more were known about the effect of temperature on these beetles it is possible that a cheap and effective means of control could be devised. A comparison of the resistance of grain weevils to gradual decreases and to sudden drops in temperature is being made. Gradual decreases are being produced in a refrigerator machine and the survival times are being plotted. Effects of sudden drops are being studied both by means of freezing point determinations and survival times of the beetles. A study is also being made of the rate and amount of change in temperature of grain in storage. Temperature records of bins of wheat have been collected throughout the United States and are being studied to determine the rate of change of temperature during the fall and winter. A study is being made of the amount of change in temperature which can be produced by running the wheat from one bin to another under various conditions of out-of-door temperatures.

ETHELBERT W. STAFFORD, M.S., Graduate Student.

A Study of the Helminths of Odonate Nymphs. (Wm. A. Riley, Adviser.)

It is well known that various insects serve as intermediate hosts of tapeworms, flukes, and roundworms, some of which are important parasites of man and domesticated animals. The best known illustrations are afforded by fleas, house flies, and related land forms. Less known, but important parasites are apparently carried by aquatic forms. The present study is an attempt to determine the rôle of *Odonate* or dragon fly nymphs in the transmission of flukes and cestodes of birds. Collections of nymphs are made in typical regions, their endoparasites recovered and studied in detail. They are then compared with adult forms found in birds.

## FORESTRY

THORVALD S. HANSEN, M.F., Assistant Professor of Forestry.

### 1. Retardation of Natural Reproduction and Yields Due to Fire.

The purpose is to determine the exact loss in quality and quantity of stands of second growth due to fire, by the examination of cut-over, burned, and unburned areas. It is found that one fire eliminates most of the coniferous reproduction except jack pine. Two fires have a detrimental effect on the rate of growth and quality of birch and poplar. Three fires often reduce the number of trees per acre far below a desirable density.

### 2. Working Plan for the Cloquet Forest Experiment Station Area.

In order to work out a plan of sustained yield for the areas, a complete stock inventory is to be taken and growth studies are to be made. Work in progress.

### 3. Quantitative and Qualitative Survey of Cut-over Lands. Second Growth of Cut-over Lands in St. Louis County. *University of Minnesota Agricultural Experiment Station Bulletin* 203. 50 pages.

Examination was made of cut-over areas on different surface formations. Sample sections were taken and intensive tenth acre plots were laid out at five chain intervals. Counts and measurements of all reproduction were made on these plots. Only four per cent of the area was found to be barren. The character of the stand had changed to predominately hardwood. Over 48 per cent of the stands being hardwoods, 24 per cent mixed, and 11 per cent coniferous. The remainder was in swamp and muskeg which was not considered in this study. The effect of fires is shown by the fact that 78 per cent of the stands was in the seedling class. An interesting fact of the

return of conifers is noted when fires are kept out. The seedling stands showed 14 per cent coniferous stands while the pole stands showed 24 per cent. This shows that the more valuable stands of softwoods will slowly return if given a chance.

#### 4. Studies in Forest Planting.

The purpose is to determine the proper species, class of stock, method of planting, and spacing to use in establishing forest stands. Stock of all native species is planted on cut-over lands of the north. Four-year-old transplant stock shows much better survival and growth at the end of ten years than do other classes of stock. Spring planting is generally more successful than fall. Dense stands of jack pine can be underplanted with a fair survival but no appreciable rate of growth.

#### 5. Thinning of Jack and Norway Pine.

The purpose is to determine the rate of stimulation of growth due to a removal of portions of crowded stands of different ages. Four plots have been established but sufficient time has not yet elapsed to determine the effect upon the remaining stand.

### HOME ECONOMICS

WYLLE B. McNEAL, M.A., Professor of Economics and Chief of the Division of Home Economics.

1. See project listed under Home Economics Education, College of Education.

2. See also the study by V. Robinson.

RUTH D. NOER, B.S., Instructor in Home Economics.

The Relation of Some Variable Factors in Certain Cotton Materials to the Tensile Strength of the Fabrics. (Thesis for the M.S. degree; under the direction of Ethel L. Phelps.)

This study is a continuation and completion of a systematic investigation of cotton underwear materials which, in thesis form, was presented for the M.S. degree by Anna Streed in 1922. Its purpose is to study the relationship between tensile strength, used as a measure of wearing quality, and certain other fabric qualities or factors. In this piece of work these factors include shrinkage, thickness, sizing, length of fiber, and yarn strength, which are compared with factors previously studied, i.e., weight and cost, thread count, yarn twist, yarn number, and tensile strength, load stretch, and regain. The fabrics used are standard cotton materials available on the open market at the time purchased, and include several grades of batiste, nainsook, cambric, longcloth, and muslin. The methods used have followed as far as possible those outlined by the American Society for Testing Materials, and the Association of Official Agricultural Chemists, or tentatively proposed by the Textile Research Committee of the American Home Economics Association.

HILDURE ANDERSON, B.S., Graduate Student.

The Relation between Sulfur Content and Tensile Strength of Wool Yarn. (Thesis for the M.S. degree; under the direction of Ethel L. Phelps.)

References to the ease with which the sulfur content of wool is decreased by treatment with fat solvents, oxidizing agents, and alkaline carbonates are frequently found in textiles literature. Such reagents are rather commonly used in the manufacture of the fiber into cloth, or in the care of the fabric while in use. This study aims to determine the actual effect of such reagents upon the sulfur content of the fiber and to show any similar variations which may occur in the tensile strength of the yarn. The yarn studied was hand spun from a fleece of known chemical history. The experimental procedure measures the sulfur content before and after treatment



with the reagent being studied, using the Benedict Denis method for sulfate determination. Tensile strength determinations are made with a single yarn tester, a record being kept of varying atmospheric conditions, such as temperature and relative humidity, which may affect the breaking point and extensibility of the material being examined.

ADELLA EPEL, B.S., Graduate Student.

The Effect of Oxalic Acid on Cotton Fabrics. (Thesis for the M.S. degree; under the direction of Ethel L. Phelps.)

Oxalic acid is used for the removal of stains on fabrics. This study aims to determine the effect of the reagent upon the fabric, a grade of cambric being employed which is comparable to that found in good ready-to-wear garments. Variations in time of treatment and of temperature are being studied. The results of the treatment are being measured by determinations of the cellulose as expressed by a copper number determination. Tensile strength measurements are carried out following the standard method adopted by the American Society for Testing Materials, with a correction for variation in regain. The Braid method for copper number determinations has been used.

DAISY I. PURDY, B.A., Graduate Student.

A Study of the Physico-chemical Properties of the Ingredients of the Products of the Batter and Dough Series in Order To Determine Their Purpose in the Mixture and Their Relation to Each Other. (Under the direction of Alice M. Child.)

The recipes and formulae used in the preparation of baked products have been secured from the trial and error method and handed on from one to the other. It is only recently that these have been studied from the scientific viewpoint. The problem undertaken is to study the exact relations between the various ingredients in cake, liquid, flour, fat, sugar, eggs, and leavening. The materials used were Minnesota hard wheat flour, granulated sugar, sweet milk, eggs, fat, tartrate baking powder. The problem is not yet completed.

VERYL ROBINSON, M.S., Graduate Student.

A Study of the Food and Health Habits of the Sixth, Seventh, and Eighth Grades in Two St. Paul Schools, with Special Consideration of the Underweight and Overweight Groups. (Thesis for the M.S. degree; under the direction of Wylle B. McNeal and Clara M. Brown.)

Special study was made of those 10 per cent or more underweight or 15 per cent or more overweight to determine nutritional status and factors affecting it and school achievement. Data were secured from (a) school records of height-weight, achievement tests, and I. Q.; (b) questionnaires filled out by pupils on diet and health habits; (c) personal interviews with those underweight or overweight or reporting no milk, fruits, or vegetables; (d) physical examinations given all the underweight and overweight children by school hygiene department.

*Summary of findings.*—(1) There appears to be a definite relationship between diet, achievement, and intelligence; lower achievement being accompanied by proportionately lower I. Q. and relatively poorer diet. (2) Diets of underweights and overweights are, in general, less satisfactory than those of average weight groups and are definitely lacking in milk, fruit, and vegetables. (3) Thirty-five per cent drink coffee, usually in place of milk. (4) Sleep habits are in general good. (5) Physical defects of more or less serious nature were found in practically all of the seventy-eight pupils examined by physicians.

## HORTICULTURE

CLARENCE E. CARY, B.S. in Agr., Assistant Professor of Horticulture.

1. Turf Construction and Maintenance.

In co-operation with the Greens Section of the U.S. Golf Association and various interested divisions at University Farm, nine strains of creeping bents (*Agrostis stolonifera*) were vegetatively planted in nursery rows in the spring of 1924. In August, 1924, thirty-six plots were broadcasted with this material for turf making. In addition twenty-four plots of as many pure grass seeds were sown for turf. During the year 1925, a variety of fertilizers will be applied to the plots to determine reaction of turf and weed control. A study of growth habits and attempts to produce viable seed will be made. Worm eradication and control of turf diseases will be studied and combinations of various grasses, from seed, for general lawn purposes will be tried. It is probable that some strains of the creeping bents will make very desirable turf in Minnesota.

2. Plant Materials for Landscape Gardening in Minnesota.

Co-operating with various plant introducers as well as local growers, a large collection of native and exotic ornamentals is being made at University Farm. These will be tested for hardiness throughout the state, at the various experimental farms, and on co-operating school grounds and farmsteads. Through these sources the desired information will be secured, over a period of years, and a series of publications will be made covering the various types of ornamentals and their fitness to serve some definite purpose in landscape compositions.

JOHN H. BEAUMONT, Ph.D., Instructor in Horticulture.

1. The Course of Pollen-Tube Growth in the Apple. (Thesis for the Ph.D. degree; W. H. Alderman, Adviser.)

2. See also the study listed under J. J. Willaman, Agricultural Biochemistry.

JAMES S. SHOEMAKER, Ph.D., Assistant in Horticulture.

Pollen Development in the Apple, with Special Reference to Chromosome Behavior. (Thesis for the Ph.D. degree; W. H. Alderman, Adviser.)

HAMILTON P. TRAUB, B.A., M.S., Assistant in Horticulture.

Research work carried on under the direction of W. H. Alderman, R. B. Harvey, R. A. Gortner, J. A. Harris, N. S. B. Gras, and F. A. Krantz.

1. Translocation of Elaborated Food in the Apple. (To be offered as a thesis for the Ph.D. degree.)

2. Breeding of Ornamental Plants. (In co-operation with W. H. Alderman and L. Sando.)

a. *Lilium*. Object: production of hardy *Liliums* of commercial importance for the Minnesota and similar climates.

b. *Paeonia*. Object: production of single and double large-flowered yellow herbaceous peonies of commercial importance.

3. Breeding of Olericultural Plants.

a. *Physalis*. Object: production of a perennial *physalis* with superior quality fruit for the home and market gardener.

## 4. Fruitfulness in Cucurbita.

Object: attempt to explain fruit-setting in cucurbita on a physiological basis.

## 5. Hardiness with Special Reference to Opuntia.

Object: an attempt to explain hardiness in the case of certain species of *Opuntia*.

## 6. History of American Horticulture. A Study in Economic History.

A complete unified account of the economic development of American horticulture to the present time. The material has been practically all gathered, and composition is about one third completed.

## PLANT PATHOLOGY AND BOTANY

ELVIN C. STAKMAN, Ph.D., Professor of Plant Pathology and Plant Pathologist, University of Minnesota Agricultural Experiment Station, co-operating with the United States Department of Agriculture.

## 1. Physiologic Specialization of Cereal Rusts.

The purpose is to determine the number, distribution, characteristics, and pathogenic capabilities of physiologic forms of cereal rust fungi. The methods used include greenhouse and field work. Many of the results have been published. The complete report on the work to date will be published within the next year.

## 2. Epidemiology of Cereal Rusts.

The purpose is to determine the factors affecting the development of cereal rusts, particularly black stem rust. The work is done throughout the Mississippi Valley of the United States and consists of observations, field experiments, laboratory, and greenhouse work to determine accurately the factors affecting the development of rusts. The results can be published only by mutual agreement between the University and the United States Department of Agriculture. These results of eight years' work are therefore not available at present, but are being prepared for publication.

3. (With J. J. Christensen.) Physiologic Specialization of *Ustilago Zeae*.

The purpose is to determine the number, distribution, parasitic capabilities, physiologic and morphologic characters of the physiology of *Ustilago zeae*. The work is done in the field with a great many varieties of corn, and also in the laboratory and greenhouse. It has been established that there are forms of *Ustilago zeae*, but the results are not ready for publication.

4. (With E. B. Lambert and H. H. Flor.) Varietal Resistance of Spring Wheats to *Tilletia levis*. *Minnesota Studies in Plant Science (Studies in the Biological Sciences)* 5:307-16. 1924.

About 870 spring-sown varieties and selections of the different botanical groups of Triticum were grown for two years, and a smaller number for five years, in order to ascertain their comparative resistance to bunt, *Tilletia levis*. In general the vulgare group seem to be susceptible; while the dicoccum group, and the monococcum group are resistant. There are great differences, however, in the resistance of different varieties within the larger groups. Marquis and Florence were the most resistant varieties in the vulgare group. Some of the hard red spring wheats, such as Marquis and Preston, are quite resistant; while others, such as Kota, Prelude, and Glyndon fife are very susceptible. In the durum group the commonly grown varieties, such as Acme, Mindum, Monad, Kubanka, and Arnautka are quite resistant. Some wheat varieties having the chromosome number of vulgare are highly resistant to *T. levis* while others of the same group are very susceptible. There appears to be no real

correlation, therefore, between chromosome number in itself and disease resistance. Additional evidence is presented to show that resistance to diseases usually is specific and not general.

5. See also the studies of J. J. Christensen, A. W. Henry, M. N. Levine, H. Hart, T. Johnson, R. M. Nelson, P. D. Peterson, W. C. Broadfoot, R. U. Cotter, J. H. Craigie, H. H. Flor, H. A. Rodenhiser, G. B. Sanford, W. F. Peel, and L. A. Schaal.

RODNEY B. HARVEY, Ph.D., Associate Professor of Plant Physiology and Botany.

1. Research Opportunities in Yellowstone National Park. *Science*, 59:548. 1924.

2. Enzymes of Thermal Algae. *Ibid.*, 60:481-82. 1924.

3. (With L. O. Regeimbal.) Physiology of Blanching Celery. *Proceedings of the American Association for the Advancement of Science*, Washington meeting, Vol. 79. 1924.

4. A New Method of Blanching Celery. *Minnesota Horticulturist*, 53:41. 1925.

5. A New Method for Blanching Celery. *Market Growers Journal* 36:264. 1925.

6. Ethylene Gas for Bleaching Celery. *Gopher Countryman*, Volume 2. February, 1925.

Abstract for Numbers 3 to 6. Discovery at this station that celery could be blanched by ethylene gas in a much shorter time than required by present means has lead to commercial applications of this process. Study has been made of the technique of blanching green vegetables and of the changes in nutritive materials in celery blanched by various methods. It has been found that plants affected with mosaic disease blanch more easily than normal plants and this condition seems of importance in the self-blanching varieties of celery.

7. See also the study by G. A. Vacha, Department of Animal Biology.

JONAS J. CHRISTENSEN, Ph.D., Assistant Professor of Plant Pathology.

1. Physiological Specialization and Parasitism of *Helminthosporium sativum* P. K. B. (Thesis for the Ph.D. degree; under the direction of E. C. Stakman.)

Physiologic forms were obtained from various parts of the world. Pathogenicity tests were made by inoculating soil with different forms of *H. sativum*. There are numerous physiologic forms of *H. sativum*. Thirty-seven forms were studied in detail. They can be distinguished in culture by the following characters: rate of growth, zonation, production of conidia, color of mycelium. The forms differ from each other pathogenically. Some forms are virulent, others are relatively weak parasites. Asexual mutation occurs frequently in some forms of *H. sativum*. The mutants arise in artificial culture as wedge or fan-shaped sectors. The spores remain viable for a long time. Spore germination is influenced profoundly by slight changes in the environment. The development of the *Helminthosporium* disease on cereals depends on several factors: the physiologic forms present; the amount of inoculum produced; the effect of environmental factors on the development of the pathogene; varietal susceptibility; and factors predisposing the host.



2. Inheritance and Varietal Resistance of Corn to *Ustilago zeae*.  
(Under the direction of E. C. Stakman and H. K. Hayes.)

The purpose was to determine the nature of inheritance of corn to *Ustilago zeae* and to obtain varieties of corn resistant to the pathogene. The material included self-fertilized lines of corn, and plants artificially inoculated. The reaction of parent lines and the  $F_1$  crosses to *U. zeae* is fairly uniform from year to year. No significant difference resulted when either of the parents was used as the staminate or pistillate one in making a cross.

3. (With J. J. Willaman.) Varietal Resistance of Sorghum to Sorghum Smut and the Effect of Environment on the Development of the Disease.

The purpose was to develop a resistant variety of sorghum to the smut pathogene. Self-fertilized lines of sorghum were used, grown on smut-sick soil. Selection in self-fertilized lines appears to be the most promising means of isolating smut-resistant strains of sorghum. Temperature relations at time of seed germination affect profoundly the amount of smut infection.

4. Varietal Resistance of Wheat to Wheat Scab. (Under the direction of E. C. Stakman.)

The purpose was to develop resistant varieties of wheat to *Fusarium spp.* Many varieties and a number of hybrids from crosses between susceptible and resistant parents were grown under epidemic conditions. Wide differences exist in the susceptibility of different varieties of wheat to scab.

ARTHUR W. HENRY, Ph.D., Assistant Professor of Plant Pathology.

1. (With E. C. Stakman.) Studies on Flax Rust. The Control of Flax Rust. *Phytopathology*, January, 1925.

These studies have been made in co-operation with the Office of Cereal Investigations and the Office of Fibre Plant Investigations, Bureau of Plant Industry, U.S. Department of Agriculture. The work has concentrated chiefly on the determination of the best methods of controlling the disease. Several immune or highly resistant seed-flax varieties have been found. As our good fiber varieties like Saginaw, and seed varieties like Winona, are susceptible to rust, these have been crossed with the immune seed types. Rust resistance appears to be dominant and segregation in the  $F_2$  indicates that immunity can be combined with the desired morphological characters. No infection of seedlings resulted from inoculating flax seed with viable urediniospores before sowing, but successful infection did occur when bits of telia were mixed with the seed. Obviously thorough cleaning of the seed is advisable. Crop rotation and early seeding are also important preventive measures.

2. Investigations of Timothy Rust.

The purpose is to ascertain whether biologic forms of this rust occur and the relative resistance of different strains of timothy to them. Collections of timothy rust, *Puccinia graminis phleipratensis*, were secured from seven widely separated places in the United States and Canada. Different strains of timothy, some resistant and some susceptible, different varieties of oats and different species of grasses were inoculated with each collection of rust. All collections so far have given the same reaction on each of the different hosts tested. Evidence of biologic specialization therefore is still lacking.

3. Investigations of Stem Rust of Oats. Co-operative Investigations with the United States Department of Agriculture.

The purpose is to determine what biologic forms of *Puccinia graminis avenae* occur in the United States and their geographical distribution. Also to ascertain the relative resistance of different varieties of oats to stem rust. Collections of rust

from approximately fifty points in the United States were cultured in the greenhouse and used to inoculate four differential hosts. A uniform rust nursery consisting of fourteen varieties of oats was grown at each of nineteen experiment stations and in nine different states. Varietal resistance tests were conducted in the field and also in the greenhouse. Form II was the most prevalent form found during the past summer, although both Form I and Form V occurred. Field results indicate that Form IV may have occurred in Texas, but owing to most of the material having passed into the telial stage when collected, this could not be confirmed in the greenhouse. The varieties Richland, Heigira Rustproof, White Tartar, and Green Mountain were found resistant.

#### 4. Flax Wilt Studies.

The tests are conducted on thoroughly "sick soil" at University Farm, St. Paul, to develop improved wilt resistant varieties. Although several good wilt resistant varieties have been developed, it is thought possible to improve upon these particularly by making the improved varieties resistant to other diseases besides wilt, by increasing the yield and by making them more readily distinguishable from susceptible varieties. Strains of flax have been found which are immune from rust as well as highly resistant to wilt. Some of these appear promising in themselves. Hybrids between these and other strains and varieties also appear valuable. Seed disinfection tests with several chemical dusts indicate their superiority over formaldehyde. Dates of seeding experiments confirm previous results in demonstrating the value of early seeding as a preventive measure against wilt.

5. Root Rots of Wheat. *University of Minnesota Agricultural Experiment Station Technical Bulletin*, 22:1-71. 1924. (Thesis for the Ph.D. degree; E. C. Stakman, Adviser.)

The purpose was to determine the fungi which cause root rots of wheat; to ascertain the effect of these fungi on the roots and on the host in general; to determine the effect of certain environmental factors on the development of several of the fungi; and to find possible control measures for root rots. Fungi were isolated from wheat seeds, wheat roots, soil, and other sources likely to harbor pathogenes of wheat roots. Pathogenicity tests and physiological studies were then conducted in agar cultures, in pots in the greenhouse, and a few in the field. The results are too extensive for a brief summary.

6. Important Fungous Diseases of the Common Sunflower. *Minnesota Studies in Plant Science (Studies in the Biological Sciences)*, 5:295-305. 1924.

The results of this study are summarized as follows:

1. As the common sunflower has increased in economic importance several fungous pathogenes have become important limiting factors in its production.

2. *Puccinia helianthi-mollis*, *Sclerotinia sclerotiorum*, *Septoria helianthi*, and *Rhysototheca Halstedii* are the pathogenes discussed in this paper, special attention being given to the last two. Mention is also made of several other fungi which attack sunflowers.

3. *Septoria helianthi* has caused a destructive leaf spot of cultivated sunflowers in Minnesota during the past few years. It was especially destructive to sunflowers grown on land which had borne this crop for several years in succession. In some instances it was more destructive than rust. It was especially prevalent during early summer, while rust was most abundant later in the season. Crop rotation, field sanitation, and the destruction of wild hosts, are suggested control measures.

4. A downy mildew, *Rhysototheca Halstedii*, caused severe stunting of late sown sunflowers at University Farm, St. Paul, in 1923. Ninety per cent of the plants in one variety were affected with this disease.

ALVIN H. LARSON, B.S. in Agr., Assistant Professor of Plant Pathology and Botany.

### 1. Seed Studies and Seed Survey.

Seeds are basic in all agricultural ventures, as practically all crop plants, whatever their ultimate uses, have their beginnings in seeds. The work of the seed laboratory offers the best available indication of the quality and kinds of seeds used, since it annually tests and analyzes 7,000 to 10,000 samples of farm crop seeds. These samples are the best index to the seed situation. It materially improves the quality of crop seeds sown, as it informs the growers whether their seeds will or will not grow and whether they do or do not contain the seeds of noxious weed plants. In addition the records of the analyses yield information relative to the sources of seeds and the shifting of crops from year to year, the introduction of new weed plants and their location, the regions in which certain crops are grown and their extent, and the association between certain crop plants and certain weeds for reports on the progress of some phases of farming.

2. (With Ruby Ure.) Some Factors Affecting the Germination of Lettuce Seeds. *Minnesota Studies in Plant Science (Studies in the Biological Sciences)* 5:289-94. November, 1924.

The effects of moisture, light, and temperature were studied. The best results are obtained by shallow planting early in the spring and by watering frequently during the first few days. The higher temperatures later in the spring make it difficult to start lettuce at that time.

### 3. Perennial Sow Thistle Studies and Survey.

One of the biggest hindrances to farming in the northwestern part of Minnesota to-day is the presence of the perennial sow thistle menace. This weed is fast making many of the farms of that area unproductive. Its advance has been rapid and its damage great. It is now to be found in all sections of Minnesota in greater or lesser amounts. The stopping of this pest is largely a matter of education and a study of the best methods of control and eradication. The advance in Minnesota has been about twenty miles a year. This study shows the seeds to be the chief cause of spread.

JULIAN G. LEACH, Ph.D., Assistant Professor of Plant Pathology and Botany.

The Seed-corn Maggot and Potato Blackleg (preliminary publication). *Science*, 61:120. 1925.

It has been shown for the first time that the seed-corn maggot is an active agent of dissemination and inoculation of the blackleg pathogen. More than 50 per cent of the blackleg disease in Minnesota is probably due to the activity of the insect. A symbiotic relationship between the insect and the bacteria have been demonstrated. The bacteria form a constant flora of the intestinal tract of both larva and adult. The larvae can not live and develop without the bacteria and the larvae of the insect aid the bacteria to overcome the tissues of the potato plant. It has been shown that the bacteria hibernate in the puparia of the insect and are deposited by the fly with the eggs on and near potato seed pieces or sprouts. Methods of control are being investigated. A similar investigation is being made of another dipterous insect and the soft rot of celery.

MOSES N. LEVINE, Ph.D., Associate Pathologist, U.S. Department of Agriculture, co-operating with the Division of Plant Pathology, University of Minnesota.

1. (With E. C. Stakman.) Physiologic Specialization of *Puccinia graminis*.

Work in progress.

2. (With O. S. Aamodt.) Physiological Evidence on the Genetic Identity of Natural and Synthetic Strains of Wild Emmer. To be published in *Phytopathology*.

A comparative study of the reaction of natural wild and synthetic wild emmers to several physiologic forms of *Puccinia graminis tritici*. The two strains reacted alike to the different stem rust forms used, furnishing additional proof of their similarity and probable genetic origin, and demonstrating again the value of parasitic organisms as physiological reagents in phylogenetic and taxonomic studies.

3. (With E. C. Stakman and Fred Griffiee.) A Common Wheat Highly Resistant to Black Stem Rust. To be published in *Phytopathology*.

Webster, a recently named variety of *Triticum vulgare* has been found resistant to 19 physiologic forms of *P. graminis tritici*. It is resistant to 5 physiologic forms to which no other variety of common wheat is known to be resistant. Webster is not a very desirable wheat from an agronomic viewpoint, but probably will be valuable in breeding for rust resistance. It has 42 chromosomes and, therefore, is a true vulgare wheat.

4. Statistical Studies on the Variation of Physiologic Forms of *Puccinia graminis tritici* and the Effect of Ecological Factors on the Susceptibility of Wheat Varieties. (Thesis for the Ph.D. degree; E. C. Stakman, Adviser.)

For the purpose of studying the effect of stem rust on different varieties of wheat under field conditions and in order to determine the occurrence of physiologic forms of *Puccinia graminis tritici* in the spring wheat region, a series of uniform rust nurseries was established at various experiment stations in the United States and Canada. There was a distinct difference in the amount of rust on different varieties at various stations in different years. Rust specimens were collected each year from the different nurseries and their identity determined by means of greenhouse inoculations. Nineteen different physiologic forms were isolated from these collections. Some of the forms isolated were abundant and widely distributed, others occurred rarely and in limited areas. A comparative morphologic study was made of eight of the most important forms. Monosporous as well as bulk cultures were used. There appear to be pronounced and significant differences in the size and shape of the urediniospores of some of the forms when all were grown under identical conditions. The parasitism of the physiologic forms is but little and only temporarily affected by external conditions. The extent and severity of rust epidemics depend on the general condition of the wheat plant at the time infection first takes place, also on favorable weather conditions, such as: suitable atmospheric temperature, plenty of soil moisture, the right amount of dew-fall at the critical moment, and sufficient sunshine.

FRANK M. EATON, M.S., Instructor in Plant Pathology and Botany.

1. Assimilation Respiration Balance As Related to Length of Day Reactions of Soy Beans. *Botanical Gazette*, 77:311-21. 1924.

2. Photosynthetic Efficiency of the Plant. *Proceedings of the American Association for the Advancement of Science*, Washington meeting, 1924-25.

This work is largely upon the relation of light exposure to photosynthesis and to flower production. In addition data have been collected upon the relation of the duration of light exposure to carbohydrate production and growth fluctuations. Mr. Eaton's thesis, which was partly completed at the time when he left the University,



is upon the relation of the osmotic concentration of the soil solution to the water requirements of plants. He is following this problem at the Chula Vista California Station of the Bureau of Plant Industry where a great amount of expensive equipment has been made available for this work.

HELEN HART, B.A., Instructor in Plant Pathology.

Factors Influencing the Development of *Melampsora Lini*. (Thesis for the M.A. degree; E. C. Stakman, Adviser.)

The investigation was undertaken in co-operation with the Office of Cereal Investigations and the Office of Fiber Plant Investigations, Bureau of Plant Industry, U.S. Department of Agriculture. The purpose was to determine the factors influencing infection, the factors influencing the development of rust subsequent to infection, and the relation of the possible occurrence of physiologic forms of the fungus. Germination of the different types of spores was studied and the effects of environmental factors such as temperature, light, moisture, and oxygen were determined. Spores were tested for their viability at different temperatures and at different relative humidities. The manner in which the pathogene enters the host and the reaction of the fungus with susceptible and resistant varieties of flax were determined by histological study. The development of rust following infection and the influence of light, temperature, and moisture were studied. Several different strains of rust from the cultivated flax and strains from the wild flaxes were used in the study of physiologic specialization. Cross inoculations were made and at least two different physiologic forms of the rust noted.

THORVALDUR JOHNSON, M.S., Instructor in Agricultural Botany.

Factors Affecting the Growth, Reproduction, and Pathogenicity of *Helminthosporium gramineum* Rab. (Thesis for the M.S. degree; E. C. Stakman, Adviser.)

The purpose was to throw some light on the conditions affecting sporulation of *H. gramineum* under artificial conditions, to investigate the mode of infection of the organism, and to find out at what temperatures infection occurs most readily. Cultural studies were made to find out the effect of environmental conditions on the growth of the organism on artificial media, and pathogenicity studies were made in the greenhouse. The organism failed to fructify under artificial conditions. It was found that in addition to the commonly affected floral infection, seedling infection is possible. Low temperatures were found favorable to infection.

RALPH M. NELSON, B.S., Instructor in Plant Pathology and Botany.

A Study of the Rots of Coniferous Timber under Different Degrees of Artificial Shade. (Under the direction of E. C. Stakman.)

The purpose is to determine the effect of ecological factors, especially temperature and moisture, on the rapidity of decay of coniferous logs; and to determine the importance of wood boring insects as disseminators of wood-rotting fungi.

PAUL D. PETERSON, B.S., Instructor in Plant Pathology.

1. Resistance of Corn Resistant to Root Rots. (To be offered as a thesis for the M.S. degree; E. C. Stakman, Adviser.)

Twenty-eight strains of three to nine years selfed corn supplied by Harvey Brewbaker of the section of plant breeding are being tested for resistance to root rots under field conditions and in the greenhouse under controlled conditions of temperature, moisture, and nutrients. Two organisms, *Gibberella saubinetii* and *Fusarium moniliforme*, commonly found associated with corn root rot in the field, are being used in the inoculation work. The nature of resistance will be studied.

## 2. Relation of Certain Molds to Disease in Cattle Caused by Feeding Sweet Clover Hay.

The purpose is the determination of the cause or causes of sweet clover hay poisoning and the means of prevention. Extensive isolations of organisms on both poisonous and non-poisonous sweet clover are being made. Feeding experiments of various types with those organisms found on poisonous sweet clover will be made by the Division of Veterinary Science. The Division of Agricultural Biochemistry will determine, if possible, the toxic principle.

## 3. Mosaic Disease of Raspberries.

This work is in co-operation with the Division of Entomology. All of the commercially important raspberries raised in Minnesota are being tested for resistance to mosaic. The host range of the raspberry mosaic "virus" will be worked out. Experiments to determine the effect of environmental factors on the appearance of mosaic have been started. Insect carriers and their host range are being determined. A state-wide "rogueing" campaign was begun last year and will be continued. Work still in progress.

## 4. Spraying for the Control of Orchard Diseases and Pests.

This work is in co-operation with the Division of Entomology. The purpose is to obtain yearly data on the best methods of disease and insect pest control. Co-operative experiments with commercial orchardists are arranged each year. Trained men from the University supervise and assist in the spraying or dusting operations. Statistical data are obtained and compiled for the purpose of checking up on the effectiveness of the control methods used.

LOUIS O. REGEIMBAL, M.S., Instructor in Plant Pathology and Botany.

### 1. Effect of Hydrocarbon Gases on the Composition of Vegetables Subjected to Them.

The purpose is to study the changes in the composition of celery, asparagus, and other vegetables that have been blanched by ethylene. Physical measurements and chemical analysis of the substances of treated and untreated plants are the methods used. Not yet completed.

### 2. Differences between Normal and Brittle Rye Straw.

The purpose is to find the difference and the causes of brittle straw in rye. The material is brittle rye straw segregating from selfed strains of rye. Analyses are in progress to determine the variations in composition of the brittle samples as compared to normal samples grown under the same conditions.

### 3. The Blanching of Celery. (See abstract under R. B. Harvey.)

WILLIAM C. BROADFOOT, B.S., Assistant in Plant Pathology.

### 1. Studies on the Parasitism of *Fusarium lini* Bolley. (Thesis for the M.S. degree; E. C. Stakman, Adviser.)

The purpose is to find out whether or not *Fusarium lini* Bolley is physiologically specialized, based upon parasitic behavior on different hosts as well as cultural characteristics on artificial media. Germination studies are also being made. The work is still in progress.

### 2. Cyanamid and Ammo-Phos Investigations.

To test the effect of cyanamid and ammo-phos on yield, amount of disease, and prevalence of weeds, when applied as a soil fertilizer. Cyanamid, 13-48 and 20-20 grade of ammo-phos, as supplied by the American Cyanamid Company are being investigated. The investigation was started April 15, 1925.

RALPH U. COTTER, M.S., Junior Agronomist, U.S. Department of Agriculture.

(1) Determination of Susceptibility of Species and Varieties of Barberry; (2) The Conditions Governing the Germination of Urediniospores. (Under the direction of E. C. Stakman.)

This work is in co-operation with the Office of Cereal Investigations, Bureau of Plant Industry, U.S. Department of Agriculture. The purpose is to determine why the spores of black stem rust blow up from the south, while the urediniospores of crown rust of oats do not. All available species and varieties of barberry used, being inoculated with telial material of stem rust. Strains of rust being investigated: *Puccinia graminis tritici*, *P. graminis avenae*, *P. graminis secalis*, *P. coronata*, *P. triticea*, *P. dispersa*, and *P. simplex*. The results are not yet available. In general, the leaf rusts seem to germinate better at a higher temperature than the stem rusts, but the stem rusts germinate over a wider range of temperatures. Both withstand freezing temperatures.

JOHN H. CRAIGIE, M.S., Assistant in Plant Pathology.

1. The Liberation, Viability, and Germination of Aeciospores of *Puccinia graminis* Pers. (Thesis for the M.S. degree; E. C. Stakman, Adviser.)

Aeciospores of this species, as well as those of nine other species of *Puccinia*, were found to be forcibly discharged from the aecium in an atmosphere of high humidity to a distance of from 0.3 to 0.7 mm. The maximum period of viability was nineteen days. The best germination took place in distilled water between 10° and 15° C., while the range of germination was from slightly above 0° C. to 25° C. Periods of high humidity in spring time afford optimum conditions for maximum liberation and germination of aeciospores.

2. The Nature of Immunity to *Puccinia graminis* of Certain Species of *Berberis*.

Leaves, varying in age from one to ten days, of immune, moderately resistant, and susceptible varieties of *Berberis* were sectioned to ascertain if by comparison of their morphology any characters could be discovered which would account for the immunity of certain species. In general, the epidermal cell walls of immune varieties are thicker than those of very susceptible ones, those of moderately resistant ones being intermediate in thickness. At present, leaves of immune varieties of *Berberis*, inoculated with sporidia of *P. graminis*, are being sectioned to discover if penetration of these leaves by the germ tubes of sporidia takes place. This work is undertaken in co-operation with the Office of Cereal Investigations, Bureau of Plant Industry, U.S. Department of Agriculture.

HAROLD H. FLOR, B.S., Assistant in the Experiment Station.

Cyanamid and Ammo-Phos Investigations. (Under the direction of E. C. Stakman.)

To determine the effect of cyanamid and ammo-phos on yield, amount of disease, and prevalence of weeds when applied as a soil fertilizer. The work was started April 15, 1925. No results yet available.

HERMAN A. RODENHISER, B.S.F., M.S., Assistant in Plant Pathology and Botany.

Experiments on the Control of Smuts of Small Grain. (Thesis for the M.S. degree; E. C. Stakman, Adviser.)

The effectiveness of various fungicides in controlling the covered smuts of wheat, oats, and barley and the effect of various chemicals on the germination and yields of

these grains were determined. Many of the liquid treatments, including formaldehyde and the organic mercury compounds, uspulun, gersman, and semesan, effectively controlled bunt of wheat. Several chemical dusts controlled bunt of wheat. It was concluded that copper carbonate, of a 20 per cent copper equivalent, may be recommended for the control of bunt in the hard red spring wheat region.

GUTHRIE B. SANFORD, M.S., Assistant in Plant Pathology.

Factors Affecting the Development of Potato Scab. (Thesis for the Ph.D. degree; E. C. Stakman, Adviser.)

The purpose is to study the factors relative to the germination, growth, reproduction, and pathogenicity of *Actinomyces scabies*, the organism causing common scab of *Solanum tuberosum*. More specifically these factors are: temperature, oxygen requirements, reactions of substrate, soil moisture, longevity of spores, critical period on the growth of the tuber for infection, the toxicity of bacteria to the scab pathogen, and the relation of green rye plants to the field control of scab. The work comprises field, greenhouse, and laboratory experiments, many of which have been in progress since October, 1924, or longer. The work is nearly completed.

WILLIAM F. PEEL, Undergraduate Student.

The White Pine Blister Rust *Cronartium ribicola* Fischer. (Under the direction of E. C. Stakman.)

The problem includes: (1) optimum temperature for germination of the spore forms involved in the life history of the fungus; (2) percentage of germination of spore forms and longevity of same; (3) determination of the incubation period of aecia and urediniospores on *Ribes* sp.; (4) determination of infection period on *Ribes* sp.; (5) possible autoecism of aeciospores, the spread of the fungus directly from pine to pine. No results or conclusions can be presented at this time.

LAWRENCE A. SCHAAL, B.S., Graduate Student.

Physiologic Studies on *Puccinia Triticina*. (To be offered as a thesis for the M.S. degree; E. C. Stakman, Adviser.)

The purpose is to make a study of this disease, with reference to the pathogenicity of the organism causing it, and as well, information regarding physiologic forms of the organism. The inoculum used in the various experiments was obtained from wheat, collected at various points in the United States. This inoculum from the various sources was run to various hosts, including wheat, barley, rye, oats, and several grasses. The host reaction of these various hosts was noted after a manner used by the Minnesota station. The work is being conducted in the Plant Pathology greenhouses at University Farm. A study of the pathogene is being made with regard to spore germination, length of incubation period, effect of light on germination and infection, and effect of temperature on germination of spores. This problem will not be finished until the fall of 1925.

## VETERINARY MEDICINE

CLIFFORD P. FITCH, M.S., D.V.M., Professor of Animal Pathology, Chief of the Division of Veterinary Medicine, and Animal Pathologist, Agricultural Experiment Station.

I. (With R. E. Lubbehusen and R. N. Dikmans.) Report of Experimental Work To Determine Whether Avian Tuberculosis Is Transmitted through the Eggs of Tuberculous Fowls. *Journal of the American Veterinary Medical Association*, 19:43-53. 1924.

The purpose of this work was to determine whether the tubercle bacillus is transmitted by a tubercular hen to her eggs. Intraperitoneal inoculations of the beaten



whole eggs were made into poultry and some of the eggs were cultured in glycerine bouillon. We examined 876 eggs from 43 known tubercular hens. Nineteen additional hens were received in the experiment, but died before they produced any eggs. Three hundred sixty-seven eggs were cultured and 509 inoculated into poultry. Three cultures developed acid fast bacteria. When these cultures were inoculated into chickens they failed to produce the disease. As a result we can not state these acid fast organisms were *Mycobacterium avium*. Eggs from two hens studied were found to contain tubercle bacteria. Only an occasional egg from those hens contained the germ. Less than 1 per cent of eggs from the tuberculous fowls actually contained living tubercle bacteria. The shells of 209 eggs from these tuberculous hens were carefully washed and examined by inoculation, but we were not able to demonstrate the presence of the germ. It would seem safe to conclude that the possibility of the transmission of avian tuberculosis by means of the infected egg is not great.

2. (With R. E. Lubbehusen.) A Study of the Presence of *Bact. Abortus* in the Milk of Cows Which React to the Agglutination Test. *The Cornell Veterinarian*, 14:299-302. 1924.

One of the most difficult problems which confront those attempting to control bovine infectious abortion is the "carrier." *Bact. abortus* is harbored in the udders of many cattle. This study was made in order to obtain some data as to what proportion of those cattle, whose blood showed the presence of agglutinating antibodies, were eliminating the germ in their milk. The sediment from the centrifuged milk was used for intraperitoneal inoculation of guinea pigs. In many cases whole milk was inoculated. After approximately four weeks, the blood of each pig as well as the milk and blood of the cows was tested by the agglutination method.

We have examined the milk of 48 animals, the blood of which reacted to the agglutination test. These examinations have been made over a period of three years. One hundred forty-four tests have been carried out. The milk of 14 cows contained *Bact. abortus* at some time. The percentage of reactors showing organisms in their milk was 29.1. The blood serum of the reactors in the milk of which *Bact. abortus* was found, always had an agglutination titre as high as 1:100 at the time the milk specimen was examined. The agglutination titre of the blood and milk may be quite different in the same individual. Milk can not be considered as a substitute for blood for a satisfactory test.

3. (With R. E. Lubbehusen and Margaret Sichler.) A Study of the Serological Tests for Bovine Infectious Abortion with Special Reference to a Uniform Method for Conducting These Tests.

The agglutination and complement fixation tests have been used for many years for the diagnosis of bovine infectious abortion. Two states now require a health certificate stating that the animals imported into the commonwealth are free of the disease on the basis of these tests. This investigation was begun by testing duplicate samples of blood serum in this laboratory and at the Michigan Agricultural College. It was found that results of the tests of such duplicates were often not the same at both laboratories. Duplicate samples were then sent to eight different laboratories and the results compared. Again it was found that there was a wide variation in the results. A conference of the workers of five different laboratories was called in Chicago in December, and at this time a uniform method was agreed upon. Duplicate samples of bovine sera are now being tested at these five different laboratories. It has been determined that the principal cause for variation in the results of the agglutination test is the difference in the concentration of the test fluid used by the different workers. It has also been found that the results obtained by the agglutination method are much more uniform than those of the complement fixation test. This work is still in progress.

4. (With W. L. Boyd) Studies of the Value of Vaccines and Bacterins in Immunizing Cattle to *Bact. abortus* (Bang). *Journal of the American Veterinary Medical Association*, 18:407-24. 1924.

Biological products have been used for many years in an effort to control bovine infectious abortion. Variable results have been reported as to their efficiency. An experimental herd of cattle has been maintained at University Farm since May, 1918. Originally this herd consisted of fourteen animals purchased at South St. Paul Stock Yards. The products used in an effort to produce immunity were living vaccines, and bacterins. Some animals were injected with so-called "blown up" bacteria by means of CO<sub>2</sub> pressure. Considerable difficulty was experienced in killing *Bact. abortus* by this method and it was finally abandoned.

As a result of this work, we believe that the following tentative conclusions are justified: The living vaccine produces some immunity to invasion of the placenta by *Bact. abortus* Bang. The degree of immunity varies according to the individual and such variations are marked. Bacterins have some immunizing value, but it is small. Living vaccines apparently do not increase the number of animals which eliminate *Bact. abortus* through the udder or discharges incident to parturition. Abortions occur in animals which have been treated with vaccines. Cattle have a marked variation in susceptibility to invasion by *Bact. abortus* Bang. The incidence of white scours does not seem to be affected by the use of abortion vaccines or bacterins.

5. (With W. L. Boyd and R. E. Lubbehusen.) An Experiment To Determine Whether a Herd Free of Bovine Infectious Abortion Can Be Kept on the Same Farm with an Infected Herd and To Compare the Breeding Efficiencies of the Two Herds.

The results of our experiments with vaccines and bacterins to control bovine infectious abortion do not indicate that they are satisfactory. Additional methods for the proper control of the disease must be sought. Under farm conditions it is often, at the present time at least, impossible to dispose of all infected animals. This experiment was undertaken to determine if it is possible to keep a herd free of the disease on the same farm with one infected with the germ. The two herds had no physical contact with each other but were tended by the same individuals. The experiment was begun in January, 1924, with seven cattle in the infected herd and fifteen in the clean herd. Monthly tests are made of the blood and the secretions and excretions are examined at frequent intervals for the presence of *Bact. abortus* Bang. At the present time only one animal has shown evidence of infection in the clean herd. The evidence is not conclusive that this occurred after the experiment was started. It is too early to draw any conclusions from the work but the breeding efficiency of the clean herd is now much higher than in the infected herd. This work will be continued for at least three years.

6. (With R. E. Lubbehusen.) Observations of the Effect of *Bact. abortus* (Bang) on the Weight of the Spleen of the Guinea Pig. *University of Minnesota Agricultural Experiment Station Technical Bulletin* 24, August, 1924.

In our studies of bovine infectious abortion, guinea pig inoculation has been an invaluable aid from the standpoint of diagnosis of infection and isolation of the organism for study from a variety of sources. It was found that many of the pigs from which *Bact. abortus* was isolated showed a definite enlargement of the spleen. Such observations prompted the gathering of data on the following questions: (1) Does *Bact. abortus* (Bang) infection manifest itself by gross pathologic changes in certain organs of the guinea pig? (2) If so, are these changes constant enough to prove of any value as an aid in diagnosis? In addition we were interested to know whether or not the source of the abortion infected material had any influence upon the nature of the post-mortem lesions. Also whether the length of the period of inoculation had an influence on the pathologic changes incident to the disease.

From the autopsy data of eighty-seven guinea pigs infected with *Bact. abortus* (Bang), the following conclusions were drawn: (1) *Bact. abortus* (Bang) infection in guinea pigs may and usually does give rise to a marked increase in spleen weight. (2) Infective materials from various sources seem to affect the spleen weight in varying degrees. (3) After twenty-four days (minimum considered) the length of the period of inoculation bears no relation to the increase in the weight of the spleen. (4) *Bact. abortus* (Bang) may be isolated from spleens which show no increase in weight or gross evidence of pathological involvement.

7. Disease in Cattle Caused by Feeding Sweet Clover Hay. Previous report in *Proceedings of the American Society of Animal Production*, 1923.

This work is being continued in co-operation with the Departments of Plant Pathology and Agricultural Biochemistry. For several years reports reached our laboratory of cattle dying that had been fed sweet clover hay. Specimens of various organs from animals dead of this condition were carefully examined bacteriologically, but nothing could be found which indicated the presence of an infectious disease. The losses occurred mostly in young cattle, but older animals were not immune. Some sweet clover hay which was thought to have caused disease was shipped to University Farm and two young heifers were placed on feed with this hay as an exclusive diet. One died in 36 days and the other in 38 days. The characteristic lesions produced were hemorrhages. The blood loses much of its power to coagulate. Another heifer was placed on feed with this same sweet clover hay, but with an additional diet of grain and corn silage. This animal grew and thrived for four months and showed no signs of illness. At the end of this period, all feed except sweet clover hay was taken away and he died in 15 days. As a result of this work the following conclusions were justified: (1) Some sweet clover hay contains a poisonous substance which will kill young cattle. Older cattle are more resistant but are not immune. (2) There is some evidence to show that the poisonous substance is produced by the action of molds on the sweet clover. This has not yet been definitely proved. (3) Sweet clover hay is usually not poisonous. (4) Experiments indicate that sweet clover hay which contains the toxic substance may be fed sparingly if properly supplemented by other feeds.

8. See also two studies listed under R. E. Lubbehusen; and one under J. J. Willaman, Division of Agricultural Biochemistry.

WILLARD L. BOYD, D.V.S., Professor of Veterinary Medicine and Assistant Veterinarian, Agricultural Experiment Station.

1. A Study of the Physiologic and Pathologic Changes Occurring in the Reproductive Organs of the Cow Following Parturition. *University of Minnesota Agricultural Experiment Station Technical Bulletin* 23, 1925. 45 pages.

This problem is being investigated for the purpose of determining the length of time necessary for the completion of normal involution; the effect of trauma in retarding involution, the relation of the corpus luteum to involution, and the manner in which bovine infectious abortion interferes with involution, especially the effect of retention of the fetal membranes, which is considered one of the phenomena of this infection. The material used consisted of animals in the university herds, dairy and beef cattle, and the experimental herd used in the investigation of infectious abortion.

*Conclusions.*—Involution consists of numerous and interesting phenomena, the most important of which is the reduction in size of the uterus. The act of involution offers a barrier to infection, but when sepsis occurs, involution is stopped or retarded. The entire amount of time required for the completion of involution varies from thirty to forty days. Retention of the fetal membranes is a serious menace to involution, not only does it retard the contractile powers of the uterus, but may seriously endanger the immediate health of the cow and her ability again successfully to reproduce. Successful control of bovine infectious abortion will mean a greatly reduced percentage of

cases of retained fetal membranes, the most common cause of subinvolution. This will result in greater breeding efficiency which is a serious problem to the breeders of purebred cattle.

## 2. The Pathology of Sterility in Cattle.

This problem is being studied for the purpose of determining the character and nature of the various pathologic changes occurring in the reproductive organs, resulting in either temporary or permanent sterility, especially in connection with bovine infectious abortion.

*Conclusions.*—The results so far obtained show that sterility is not usually directly due to the invasion and reproduction of *Bacterium abortus* Bang. The Bang organism however, paves the way for secondary invaders, which produce changes which may result in temporary or permanent sterility. Cystic degeneration of the ovaries, cervicitis, endometritis, pyometra, salpingitis and persistent corpora lutea, are of common occurrence in sterile cows. Orchitis, due to *Bacterium abortus* Bang is occasionally encountered in sterility of the sire. Sterility as the result of inflammation of the seminal vesicles has been less frequently observed. The treatment of sterility has been developed to the extent that many cows affected with various pathologic changes of the various reproductive organs, except the diseases of the oviducts, can often be returned to normal breeding condition. The treatment of diseases of the uterine tubes or oviducts remains undeveloped. Surgical interference, in those cases in which the disease is unilateral, is at times apparently productive of good results.

## 3. The Importance of the Corpus Luteum to the Breeding Efficiency of Cattle.

This project is being studied in the attempt to determine the relation of the corpus luteum to the estrous cycle and to reproduction. Methods employed consist largely of data collected from clinical cases, though histo-pathologic studies are made whenever possible. The corpus luteum has been found to have a close relationship to estrum. The corpus luteum, when retained, inhibits estrum through mechanical interference, and possibly by means of an internal secretion. This makes it an important factor in breeding efficiency. The removal of the corpus luteum by pressure exerted through the walls of the rectum or vagina, provided no other pathologic conditions are present, will usually be followed by estrum within three to five days. The removal of the corpus luteum in the treatment of pyometra is a valuable adjunct in perfecting a permanent cure. The removal of the corpus luteum in cows affected with mummification of the fetus, provided the fetus has not inhabited the uterus over a long period of time, will usually bring about expulsion of the desiccated cadaver within a few days. The removal of the corpus luteum has been found to be of great assistance in terminating pregnancies in cows which have been bred to scrub sires or which have accidentally been bred too young. The corpus luteum is an important factor in relation to reproduction of cattle, and the careful manipulation of it is attended by increased fertility. The corpus luteum is of great importance, also from the standpoint of the diagnosis of pregnancy.

## 4. See also three studies listed under C. P. Fitch.

MYRON H. REYNOLDS, B.S.A., D.V.M., M.D., Professor of Veterinary Medicine and Veterinarian, Agricultural Experiment Station.

## A Study of the Use of Tuberculin in the Diagnosis of Tuberculosis in Cattle.

The material used has been the several university herds in connection with herd and individual animal tests. The data are collected, analyzed, and filed for future study and publication. Some of the conclusions reached thus far are as follows: (1) The accuracy and efficiency of tuberculin tests depend more on factors other than plain showing of tuberculin and less on the tuberculin alone, than has been generally believed. (2) A herd may easily be immunized against thermal and even intradermal



tests, therefore doses as small as may be consistent with efficiency should be used. (3) For young cattle, we should avoid thermal test entirely and use no more of the intradermal than is reasonably necessary. (4) All unnecessary use of intradermal and thermal tests on older cattle should be avoided, on account of the danger of rendering future tests by these methods inaccurate, and thus greatly impairing our chief factor in control work.

EARL A. HEWITT, B.A., B.S., D.V.M., Assistant Professor of Veterinary Medicine and Assistant Veterinarian, Agricultural Experiment Station.

### 1. Benzoic and Hippuric Acid Elimination in the Urine of Cattle.

The purpose of this study was to attempt to apply the Kingsbury-Swanson renal function test to cattle. This renal function test is one in which the ability of the kidney to eliminate hippuric acid at a definite and rapid rate, after the ingestion of a definite amount of sodium benzoate, is the criterion. It was found that this renal function test is not applicable to cattle for several reasons; principally, because the amount of hippuric acid normally eliminated is so great that slight increases or decreases are insignificant. The diet of cattle (hay, etc.) contains considerable amounts of benzoic acid which causes the formation of large amounts of hippuric acid with a tendency to a wide range of variation; also the age and size of the animal are factors in the production of hippuric acid. It was also found that cattle are not as efficient in conjugating hippuric acid in the body as are some animals (the human), because the administration of sodium benzoate increased the elimination of free benzoic acid. The administration of uranium nitrate to produce kidney injury did not impair the ability to eliminate hippuric acid, suggesting that, as in the case of other herbivora (rabbits), the kidneys may not be the sole seat of the formation of hippuric acid. The rate of absorption of sodium benzoate from the digestive tract was found to be relatively much slower than in the case of the human.

### The Morphology of the Blood of Pregnant Cows Through the Period of Parturition.

Samples of blood are collected every few days from animals beginning four or five weeks previous to calving and continuing for four or five weeks after calving. The blood of the calf is studied with that of its mother. Counts are made of the red blood cells, white blood cells, and blood platelets, as well as differential counts of the white blood cells. The data available as yet do not warrant any final conclusions. There appears to be a polycythemia, together with a lymphocytosis at the time of parturition.

HOWARD C. H. KERNKAMP, D.V.M., Assistant Professor of Veterinary Medicine and Assistant Veterinarian, Agricultural Experiment Station.

### 1. A Study of a Disease of the Bones and Joints of Swine.

A few years ago a disease in swine characterized by lameness and parietic-like symptoms frequently occurred, involving the bones and joints. The problem was attacked from the assumption that the disease was of trophic origin. Earlier experiences eliminated micro-organisms as etiological agents in this disease. Seventy-five healthy swine of about eighty pounds in weight and representing the principal breeds were grouped in various lots and fed carefully controlled rations. The basal ration consisted of shelled yellow corn and salt (sodium chloride). This was particularly low in calcium, protein, and vitamin C. Other rations were used which provided larger amounts of these elements. Symptoms of stiffness, lameness, and later loss of locomotion, developed in 52 per cent of the swine receiving rations low in calcium, regardless of whether protein or vitamins were supplied. None of the pigs receiving 2 per cent of calcium carbonate in the ration developed clinical evidence of the disease. We can conclude (1) that diets low in calcium are conducive to the development of an osteo-arthritis in swine; (2) that if calcium be added to a deficient ration it will

supply the deficiency and prevent this disease; (3) lime, slaked, dried, and pulverized makes a suitable material to use when calcium is the element to be supplied.

2. Goiter in Poultry. *Journal of the American Veterinary Medical Association*, 20:223-28. 1925.

Goiter in mammals is not uncommon. It occurs most frequently in man, but also in all domestic and many wild animals, though rarely noted in birds. The present study includes two cases of thyroid enlargement in poultry. Histological examination showed the typical lesions of simple colloid goiter.

3. Exudative Peritonitis in Poultry Due to a Streptococcus.

Three Barred Rock hens were examined which showed a severe exudative peritonitis. An investigation at the farm from which these birds came revealed that many were sick and dying with similar lesions. A streptococcus of the Beta type in pure culture was obtained from the exudate, liver, spleen, and heart's blood. The disease has been reproduced by intravenous and intraperitoneal injections into susceptible hens. The organism has been subsequently recovered in pure culture. Rabbits and guinea pigs are not affected by intravenous and intraperitoneal injections of cultures of the germ. Further study of this organism is under way.

4. Flukes of the Genus *Collyriclum* As Parasites of Poultry. (See abstract under W. A. Riley, division of Entomology and Economic Zoology.)

RAYMOND E. LUBBEHUSEN, B.S., D.V.M., Assistant Professor of Comparative Pathology and Assistant Pathologist, Agricultural Experiment Station.

1. (With C. P. Fitch.) A Study of the Value of Living Vaccines (*Bact. abortus* Bang) in the Control of Bovine Infectious Abortion in a Large Dairy Herd.

The study thus far represents our observations on 61 animals over a period of two and one-half years. Twenty-four animals were vaccinated by means of the subcutaneous injection of a saline suspension of living *Bact. abortus* (Bang); the remaining 37 animals were left as controls. The data on each individual include the number of normal calvings, number of abortions, bacteriologic examination of all placenta, fetuses, and milk, as well as serologic tests at repeated intervals. Thirty-five pregnancies in the group of 24 vaccinated animals terminated in 4 abortions (11.43 per cent), 3 of which (8.57 per cent) were proven to be due to *Bact. abortus* (Bang). Fifty-two pregnancies in the group of 37 control animals terminated in 11 abortions (21.2 per cent), of which 7 (13.4 per cent) were proved to be due to *Bact. abortus* (Bang.) Of the vaccinated group, 37.5 per cent, and of the control animals, 27 per cent, eliminated the organism in the uterine discharges or milk and thus may be viewed as spreaders of the infection. While it is desirable that more data be available before definite conclusions are drawn, it would appear from the foregoing observations that the use of living *Bact. abortus* vaccines will reduce the abortion rate, but that their use should be confined to those herds showing a high percentage of infection; also that living vaccines will not reduce the abortion rate to a desirable minimum.

2. A Study of Antigens and Their Relation to the Complement-Fixation Test for Bovine Infectious Abortion.

While much work remains to be done, there are several points upon which rather definite conclusions can be drawn. (1) The age of the organism does not seem to influence the antigenic properties, as very old cultures after innumerable transfers retain the same antigenic titre exhibited when freshly isolated. (2) The antigenic properties of the organism are influenced very materially by the source of isolation. Whether this influence is due to a difference in pathogenicity has not been determined.

3. (With C. P. Fitch.) The Bull As a Factor in the Spread of Bovine Infectious Abortion.

This study comprises observations on twelve bulls and two heifers. Infection of the bulls by the administration of live *Bact. abortus* is by either one or a combination of three channels: (a) intravenous injection, (b) drenching, and (c) douching of the sheath or direct injection into the urethra. In some of the individuals where infection failed by means of the last two named methods, the organisms were injected directly into the testicular tissue. During life the semen of mature bulls was examined at intervals by direct culture and guinea pig inoculation to determine the possible presence of *Bact. abortus* (Bang). *Conclusions.*—(1) Bulls are not readily infected through the natural channels of infection, namely, per orem or by way of the urethra. This conclusion is supported by clinical observation and serologic tests in which only a small percentage of bulls show active infection. (2) Many bulls giving a positive reaction to the serologic tests for infectious abortion do not harbor *Bact. abortus* (Bang) in the genital organs. (3) Repeated examination of the semen of those bulls known to harbor the organism in the genitalia failed to show the presence of *Bact. abortus* (Bang). (4) Although the experimental data presented on channels of infection in heifers are not sufficient to warrant definite conclusions, it would appear that heifers are not readily infected by way of the urethra and posterior vagina.

4. See also five other studies listed under C. P. Fitch.

## THE LAW SCHOOL

### THE MINNESOTA LAW REVIEW

The *Minnesota Law Review* is a legal periodical published by the Law School of the University. Publication was begun in 1916-17 and the ninth volume is now complete. Eight numbers are published each year from November to June inclusive. It has at present over 1,200 subscribers, most of whom are in Minnesota, but a number of whom are judges and lawyers in other states. Among its subscribers are the libraries of the courts of last resort in almost all the states and a few in foreign countries. It is the official organ of the Minnesota State Bar Association and goes to all members of the Association.

The *Review* is under the direction of the faculty of the Law School. Professor H. J. Fletcher is its editor-in-chief and Professor James Paige its business manager. The University does not contribute any money to its support.

The contents are made up of articles by members of the faculty of the Law School, and of other schools giving the results of their research in various fields of the law, state and national. Judges and lawyers of Minnesota and elsewhere make valuable contributions to its pages. It co-operates especially with the bar of Minnesota in suggesting improvements in the law of the state. A section is devoted to notes and comments on recent decisions of American and English courts. This section is conducted by the ablest students in the junior and senior classes of the Law School. The *Review* publishes the proceedings and committee reports of the State Bar Association.

Articles contributed by the faculty of the Law School during the current year are included in the following list.

EVERETT FRASER, B.A., LL.B., Dean of the Law School and Professor of Law.

The Rules against Restraints on Alienation and against Suspension of the Absolute Power of Alienation As Applied to Trusts in Minnesota. *Minnesota Law Review*, 9:314-52.

R. JUSTIN MILLER, B.A., LL.B., J.D., Professor of Law.

Jury Triers. *Minnesota Law Review*, 9:353-61.

HENRY ROTTSCHAEFER, B.A., J.D., S.J.D., Professor of Law.

Valuation in Rate Cases. *Minnesota Law Review*, 9:211-39.

HENRY L. MCCLINTOCK, S.J.D., Assistant Professor of Law.

The Administrative Determination of Public Land Controversies. *Minnesota Law Review*, 9:420-41; 542-54. (Concluded in the June number.)



## THE COLLEGE OF DENTISTRY

NOTE.—The investigations by Professor O. E. Harder, on the physical properties of various materials used in dentistry, are listed under the School of Mines.

HAROLD J. LEONARD, B.A., D.D.S., Associate Professor of Oral Hygiene and Pathology.

The Relation of Calcium Metabolism to Dental Disease. (See abstract under Medical School, Department of Physiology and Physiological Chemistry.)

WILLIAM D. VEHE, D.D.S., Associate Professor of Crown and Bridge Work and Operative Dentistry.

The Crushing Strength of Dental Porcelains.

The purpose is to determine the crushing strength of dental porcelains and to determine this in relation to the fusing point. The dental porcelains now available are the materials used. The results are not yet completed.

GEORGE A. MONTELIUS, D.D.S., Assistant Professor of Oral Diagnosis.

The Evolution of Human Dentition, and Its Correlation with Structure and Function.

A study of the evolution of dentition in the lower and the higher animals, including both fossil and contemporary apes. The evolution of the teeth in man will be followed through prehistoric times, in the Old World and in the New.

Variations in the dentition of contemporary man will be studied in relation to race, sex, age, and foods. Special attention is paid to correlations of dentition with (1) types of skull and of facial region; (2) type of mandible; (3) use and disuse; and (4) physique and other physical characteristics.

## THE SCHOOL OF MINES

NOTE.—A detailed account of the work of the Minnesota School of Mines Experiment Station is given by the director, Dean William R. Appleby, in the President's Report for the year 1924-1925, *Bulletin of the University of Minnesota*. (In press.)

OSCAR E. HARDER, M.A., Ph.D., Professor of Metallography.

### 1. Effect of Heat Treatment on Impact Toughness of Steels.

The purpose of this investigation is to determine the best heat treatment for the various kinds of steels in order to give the greatest toughness and at the same time to meet other requirements. Most of the steels listed in such specifications as the Society of Automotive Engineers have been included in this investigation, or it is planned to include them in future work. The tests are being made on standard Charpy notch impact bars with the American-made Charpy machine. Although a number of steels have been studied, it is not considered advisable to draw conclusions until the investigation is completed.

### 2. Effect of Temperature on Impact Toughness of Heat Treated Steels.

This research has a special bearing on the properties of steels at low temperatures. The large number of accidents which occur annually which are attributed to brittleness of steel at low temperature will justify a very extensive study of the effect of temperature on the toughness of steel. The methods used in this investigation are similar to those in the one discussed above. The tests are being made over a range of temperature from the melting point of carbon dioxide snow up to about 500° C.

### 3. Properties of Waxes Used in Dentistry.

The properties of the waxes used by the dentist in preparing his wax models have a very important bearing on the success or failure of his final product. In this investigation a number of commercial dental waxes, particularly those recommended for inlay models, and the pure waxes which are used in the preparation of the waxes used in dentistry, have been studied. The properties studied have included softening point, smoking point, flash point, coefficient of expansion, and crushing strength. The influence of temperature of testing on the crushing strength has also been investigated. The two results of importance to the dental profession are that the coefficient of linear expansion varies from .000110 to .00168 inches per inch per one degree F., and that the crushing strength is very materially modified by temperature and at any given temperature it is quite different for the different waxes on the market at the present time. As a result it is to be expected that the most accurate reproductions will be obtained by using those waxes which have low coefficients of expansion and which are adapted to use without requiring chilling to low temperatures for the purpose of carving.

### 4. Studies on Plasters and Investments Used in Dentistry.

This work has covered the setting, hardening, crushing strength, and effect of temperature on crushing strength and dimensions of plasters and various kinds of investments which are usually plaster mixed with finely divided silica. It has been shown that by studying the thermal changes during the setting of cement, the time of setting can be determined quite accurately. This is best done by placing a thermometer in the mass of plaster while it is setting and then insulating the plaster so as to minimize the heat losses. The effect of various types of accelerators can be studied very conveniently by this method. The increase in the crushing strength

with aging under various conditions has been studied, as has the effect of heat on the crushing strength and water content of certain plasters.

Other important relations which have been studied are the crushing strengths and volume changes produced by various amounts of heating. The crushing strength of plaster decreases rapidly when it is heated to temperatures just slightly over the boiling point of water, at which temperature it begins to lose a part of its water of crystallization. The volume of plasters decreases by heating, and decreases of as much as 4 per cent in linear dimensions have been observed in case of specimens heated to 600-700° C.

#### 5. Properties and Microstructures of Alloys Used in Dentistry.

The purpose of this investigation has been to determine more definitely the properties of various alloys (gold alloys) which are in use at the present time in the dental profession, and, if possible, to develop alloys of better properties. Materials included in this investigation are the pure metals and commercial dental alloys for the most part. These dental alloys contain various combinations of gold, silver, copper, nickel, platinum, and palladium. The tests which have been made have included specific gravity, hardness, tensile strength, elongation, reduction of area, and melting point. A wide variation in the properties has been found. The results show that there are certain types of alloys which are suitable for certain types of work in dentistry, and that in order to get the best results in practice the dentist should have a thorough knowledge of the properties of the metal with which he is working. The determination of the physical properties of the alloys has been accompanied by studies of the microstructures.

#### 6. Heat Treatment of Gold Alloys.

The purpose of this investigation has been to determine the influence of heat treatment on the properties of certain gold alloys, and since it was observed that it is possible to modify their properties by heat treatment, to work out the best heat treatment for a given desired set of physical properties. A brief discussion of the theory involved has been published (*Journal of American Dental Association*, 10:869-74, 1923). It appears that the heat treatment of dental alloys, particularly in the case of certain compositions, will be just as important as the heat treatment of steel.

#### 7. (With Ralph L. Dowdell.) The Application of Dimensional Changes in Steels during Heating to the Control of Their Heat Treatment.

This work has for its purpose a study of dimensional changes in steel during heating, and the utilization of these changes as a guide to the proper heat treatment of steels. Two pieces of apparatus have been developed which can be used to follow dimensional changes in steels during heating, and it has been shown that these dimensional changes may be used as a guide in heat treating.

#### 8. See also the studies by O. W. Potter, G. A. Johnson, and J. Sodoma.

ANDERS J. CARLSON, C.E., Assistant Professor of Mine Plant and Mechanics.

Moisture Content of Minnesota Iron Ores, with Special Reference to Criteria for Estimating Moisture Content from Chemical Analyses. (Thesis for the M.S. degree; O. E. Harder, Adviser.)

Moisture determinations can not be made from drill samples, and since the moisture content is necessary to determine the merchantability of an ore, an estimate of it must be made. For the period 1917-24, data from two sources were worked up into curves. The first consists of cargo analyses of all shipments of Minnesota ores. This information is published in booklet form each year by the Lake Superior Iron Ore Association. The second consists of data on chemical analyses and moisture content,

for most of the ore bodies in the state, used by Professor E. M. Lambert and the author in working up ore estimates for the Minnesota Tax Commission.

The data were tabulated and assembled in different ways so as to develop any possible relations between moisture and each of the other constituents of an ore. The results indicated that moisture may be estimated most accurately from the iron plus silica content or the alumina content of an ore; that the relations between moisture and each of the other constituents are indefinite and do not provide any criteria; that the physical structure of an ore must be considered besides its chemical analysis if the moisture is to be accurately estimated.

RAYMOND W. ALLARD, E.M., Instructor in Mining Engineering.

Investigation and Application of Ore Dressing Practice Suitable for the Beneficiation of Low Grade Minnesota Iron Ores. (Thesis for the M.S. degree; W. R. Appleby, Adviser.)

RALPH L. DOWDELL, Met.E., M.S., Instructor in Metallography.

#### 1. Study of the Structure of Heat Treated Steels.

This work has had for its purpose a better understanding of the scientific principles involved in heat treating steels, and of the structures of the steels at various steps in the heat treatment. This is a subject on which there has been much controversy and while there has been a great deal of research work the conclusions reached by different investigators have not been in good agreement. The work is being carried on largely from the standpoint of microscopic and thermal analysis. It is expected in the near future to make some use of the X-ray apparatus in connection with this investigation.

#### 2. See also the study by C. F. Scheid.

LUDWIG J. WEBER, M.S., Ph.D., Instructor in Metallography.

#### Carburization of Steel Welds.

It is found desirable in some commercial practice to carburize welded parts. Furthermore, the theoretical consideration of whether or not it is possible to carburize steel which has been melted by any of the commercial processes and applied in the molten condition to form a weld between two pieces of steel in the solid form has been the subject of considerable disagreement. The investigator has studied welds made by the various commercial forms of welding including the hammered lap weld, the acetylene weld, and the electric weld. The method of operation has been to take these welds, study them under the microscope, and then subject them to carburizing treatment and again study the microstructure.

CARRIE H. GREEN, Assistant in Metallography.

Eutectic Patterns in Metallic Alloys. *American Institute of Mining and Metallurgical Engineers* No. 1421-E, February, 1925.

The purpose of this investigation has been to review the results published by other investigators, notably F. L. Brady and A. Portevin, and to illustrate eutectic patterns. A study has been made of many typical eutectic patterns and certain generalizations with regard to the types of structures found in eutectic patterns have been made possible as a result of this investigation.

GEORGE A. JOHNSON, Undergraduate Student.

Effect of Temperature and Rate of Testing on the Properties of Metals and Alloys. (Metallurgical Engineer's thesis; under the direction of O. E. Harder.)

The tests have been made on steel wire of about .24 per cent carbon and on brass of the 68 Cu-32 Zn type. Tests have been made at various temperatures from room temperature up to 750° C. for the steel wire and to 600° C. for the brass.



ORRIN W. POTTER, M.S., Instructor in Drawing and Descriptive Geometry.

Effect of Heat Treatment on the Properties and Microstructure of Cast Gray Iron and Semi-Steel. (Thesis for the M.S. degree; under the direction of O. E. Harder.) To be published (in part) in the *Transactions of the American Foundrymen's Association*, 1925.

Samples of gray iron and semi-steel have been examined to determine their chemical composition and physical properties. These samples have then been subjected to various types of heat treatment to determine the effects on their chemical composition, physical properties, dimensional changes, etc. This work has been done with a view to determining the relative merits of cast iron and semi-steels, and the best possible heat treatment in order to produce a given set of physical properties.

JOSEPH SODOMA, Undergraduate Student.

Tellurium and Its Binary Alloys with Special Reference to Tellurium and Tin Alloys. (Metallurgical Engineer's thesis; under the direction of O. E. Harder.)

The purpose of this investigation has been to aid in the development of further and better uses of metallic tellurium, which is at the present time available in considerable quantities as a by-product in certain metallurgical processes, and which finds comparatively little use. A study has been made of the literature, and the properties of metallic tellurium determined. The tellurium-tin constitution diagram has been studied by the methods of thermal analysis and microscopic examination.

CARL F. SCHEID, Undergraduate Student.

The Annealing of Tool Steels. (Metallurgical Engineer's thesis; under the direction of R. L. Dowdell.)

The purpose of this investigation has been to work out the best heat treatment to be used in annealing various kinds of tool steels, keeping in mind the desired qualities and the cost of the operation. The factors which have been studied are the temperature of annealing, time at the annealing temperature, and the rate of cooling. The tests are being studied with reference to the character of the fracture, the microstructure, and the hardness.

## THE COLLEGE OF PHARMACY

FREDERICK J. WULLING, Phm.G., Phm.D., LL.M., Dean of the College of Pharmacy.

A Study of the Educational Standards of All American Colleges of Pharmacy.

This work was undertaken with the view toward the establishing of a classification to include all of the colleges. It has been under way since March 1, 1925.

GUSTAV BACHMAN, Phm.D., Professor of Pharmacy.

1. An Examination of the Degree of Conformity of About Thirty Galenicals, Obtained in the Open Market, to U. S. Pharmacopoeial Requirements.

2. An Inquiry into the State of Purity of Some of the Official Inorganic Medicinal Chemicals.

The results of these two researches are to be presented as reports to the next annual meeting of the Minnesota State Pharmaceutical Association, in February, 1926.

EDWIN L. NEWCOMB, Phm.D., Professor of Pharmacognosy, and EARL B. FISCHER, B.S., Instructor in Pharmacognosy.

1. Research in Problems Connected with the Important Work of Revision of: (a) U. S. Pharmacopoeia (10th Decennial Revision) and (b) National Formulary (5th Revision).

This work involves such a large number of topics that it is impracticable to abstract it in detail.

2. Continuation of Digitalis Research.

CHARLES H. ROGERS, D.Sc. in Phm., Associate Professor of Pharmacy, Department of Pharmaceutical Chemistry, College of Pharmacy, University of Minnesota, and

CHARLES V. NETZ, Phm.C., B.S., Instructor in Pharmacy.

The Quantitative Determination of Alkaloids in Extractive Residues by Means of Freezing Point Depressions, Using the Cryoscope.

# THE SCHOOL OF CHEMISTRY

## ANALYTICAL CHEMISTRY

PAUL H. M.-P. BRINTON, Ph.D., Professor of Analytical Chemistry and Chief of the Division.

1. (With R. B. Ellestad.) The Determination of Uranium in Carnotite. *Industrial and Engineering Chemistry*, 16:1191-92. 1924.

2. (With A. E. Stoppel.) The Ignition of Precipitates. II. Conversion of Molybdenum Sulphide into Oxide, and the Volatility of Molybdenum Trioxide. *Journal of the American Chemical Society* 46:2454. 1924.

Molybdenum trioxide is non-volatile below 500° and volatilizes only very slightly between 500° and 600°. Hence the conversion of molybdenum trisulphide to the oxide in analysis may be carried out by heating the sulphide precipitate with the filter-paper at 600° in a crucible suspended in an improvised air-muffle, consisting of a large crucible with a dish of asbestos in the bottom.

3. (With A. E. Stoppel and C. F. Sidener.) The Iodimetric Determination of Vanadium. *Journal of the American Chemical Society*, 46:2448. 1924.

The vanadium in a concentrated neutral solution of a vanadate may be accurately determined by adding to 10 c.c. an equal volume of 6 N— mineral acid (e.g., hydrochloric or sulphuric, but not acetic acid), and a few grains of potassium iodide, and then, after considerable dilution, titrating with standard thiosulphate solution. The liberated iodine is exactly equivalent to the reduction of vanadium to the quadrivalent vanadyl stage. The operations must be conducted without undue delay. To insure all the vanadium being in the quinivalent condition, it should be previously oxidized with alkaline hydrogen peroxide solution, the excess of the latter being destroyed by boiling. Small quantities of molybdenum do not interfere if phosphoric acid is used for the mineral acid, but the presence of tungsten causes low results. Uranium must be absent.

4. Standard Methods of Chemical Analysis. Edited by W. W. Scott. Section I, Thorium. Section II, Zirconium. A book to be published by D. Van Nostrand and Company. 1925.

5. See also the studies by L. A. Sarver, A. E. Stoppel, R. B. Ellestad, T. Kameda, and E. E. Bauer.

ISAAC W. GEIGER, Ph.D., Associate Professor of Analytical Chemistry.

A New Volumetric Method for the Determination of Cobalt.

The purpose is the development, if possible, of an accurate oxidation-reduction method for cobalt which will be more rapid than any present known methods.

LANDON A. SARVER, Ph.D., Assistant Professor of Analytical Chemistry.

The Solubility Relations of the Rare Earth Oxalates. (Thesis for the Ph.D. degree; P. H. M.-P. Brinton, Adviser.)

The problem involved the collection of solubility data, and determination of conditions for quantitative precipitation of rare earth oxalates; the collection and purification

tion of rare earth materials; the design of apparatus, and working out of methods for solubility determinations on small quantities of material.

Six rare earth oxalates were highly purified, and spectra photographed; large thermostat and mixing apparatus designed; solid allowed to settle out from solution in thermostat, and clear solution was then removed with special pressure pipette; weighed samples evaporated, ignited to oxides, and weighed. Solubility tables compiled, and curves drawn. Analytical conditions prescribed, a half normal hydrochloric acid solution, in which the excess oxalic acid is also half normal, being recommended.

ARTHUR E. STOPPEL, Ph.D., Instructor in Analytical Chemistry.

1. (With C. F. Sidener and P. H. M.-P. Brinton.) The Iodimetric Determination of Vanadium. (See abstract under P. H. M.-P. Brinton.)

2. (With P. H. M.-P. Brinton.) Studies on the Ignition of Precipitates. II. The Conversion of Molybdenum Sulphide to the Oxide, and the Volatility of Molybdenum Trioxide. (See abstract under P. H. M.-P. Brinton.)

These two articles were taken from a thesis by A. E. Stoppel, offered for the Ph.D. degree, working under the direction of C. F. Sidener (until his retirement in 1923) and later under P. H. M.-P. Brinton.

REUBEN B. ELLESTAD, B.S., Assistant in Analytical Chemistry.

1. A Study of the Uranates of the Alkali Metals, and of the Separation of the Alkalies from Uranium. (Under the direction of P. H. M.-P. Brinton.)

2. (With F. A. Gray.) Crystal Measurements of the Double Nitrates of Neodymium and Praseodymium with Mg, Zn, Mn, Co, Ni, and Fe.

3. A Modified Method for the Determination of Uranium in Carnotite. (See abstract under P. H. M.-P. Brinton.)

TOHRU KAMEDA, B.S., Assistant in Analytical Chemistry.

A Critical Study of the Determination of Zirconium by Precipitation with Selenious Acid. (Thesis for the M.S. degree; P. H. M.-P. Brinton, Adviser.)

The method used was that proposed by Smith and James (1920).

*Conclusions.*—To get pure zirconium selenite it is not advisable to heat a long time after precipitation. The solubility of zirconium selenite in 3 per cent hydrochloric acid solution, suggested washing solution in the original article, is quite high; however, by the addition of selenious acid this difficulty will be overcome. Prolonged heating after clear melt with potassium acid fluoride tends to loss of zirconium fluoride by the volatilization; however, with a careful fusion there seems to be no loss of zirconium. Tungsten, tantalum, columbium, lead, copper, bismuth, manganese, zinc, nickel, cobalt, beryllium, and uranium do not interfere with the determination. Over 30 per cent of  $\text{Fe}_2\text{O}_3$  in the resulting  $\text{ZrO}_2$  also does not interfere if it is treated carefully.

ESTHER E. BAUER, M.S., Graduate Student.

Determination of the Atomic Weight of Zirconium. (Thesis to be offered for the Ph.D. degree; P. H. M.-P. Brinton, Adviser.)

The exact atomic weight of zirconium is not known, because absolutely pure zirconium free from hafnium has never been prepared. The purpose of the present research, therefore, was to prepare pure zirconium and then determine its atomic weight. As yet, no satisfactory results have been obtained. This work was begun at the Sorbonne, Paris, under the combined direction of Dr. Brinton and Dr. G. Urbain.



RUTH E. ELMQUIST, B.A., M.S., Dupont Fellow in Chemistry.

The Study of Zirconium. (Thesis to be offered for the Ph.D. degree; P. H. M.-P. Brinton, Adviser.)

Although considerable attention has been directed toward zirconium in recent years, little is definitely known concerning the chemistry of the compounds of zirconium. The lower valence compounds of zirconium are being studied. The question of the existence of alpha and beta zirconium hydroxide and of meta zirconic acid is being investigated. The degree of hydrolysis of zirconium salts is being determined. This work was begun at the Sorbonne under the combined direction of Dr. Brinton and Dr. G. Urbain.

## CHEMICAL ENGINEERING

CHARLES A. MANN, Ph.D., Professor of Chemical Engineering and Chief of the Division.

### 1. New Organic Compounds of Aluminum.

Considerable progress has been made on this problem, but the results are not yet available.

### 2. Action of Treated and Untreated Natural Waters on Soluble Prussian Blue Laundry Blueing.

Work in progress, but results not yet available.

### 3. (With P. M. Paulson.) Electrochemical Oxidation of Toluene to Benzaldehyde. *Transactions of the American Electrochemical Society*, 47:31. 1925. (Thesis by P. M. Paulson for the degree of M.S. in Chem. Eng.; C. A. Mann, Adviser.)

Experiments were undertaken on the electrochemical oxidation of toluene with the object of controlling the oxidation to secure a maximum yield of benzaldehyde regardless of other products. Electrodes of sheet platinum were used. A diaphragm was found to be unnecessary. Various solvents for toluene were tried out. Acetone, alcohol, and carbon tetrachloride proved to be unsatisfactory. The main objection to ether is its low boiling point. Highest yields (19 per cent) were obtained upon the electrolysis of toluene-acetic acid nitric acid mixture. The reaction is distinctly an electrochemical one: experiments carried out under identical conditions but without applied e.m.f. produced no trace of benzaldehyde.

### 4. The Effect of Chemicals on Metals and Alloys under Varying Temperature and Concentration Conditions.

The purpose is to determine the suitability of metals and alloys and particularly the newer alloys for constructing apparatus for handling chemicals of corrosive nature or for constructions exposed to corrosive gases and chemicals. Each metal or alloy is exposed to a large variety of chemicals under the same temperature and the same concentration of the chemical. The loss in weight of the material is recorded per unit of area over a definite time of exposure. The analysis of the alloys will also be given. Thirty-six metals and alloys have been tested at the same temperature with eight different chemical substances of varying concentrations. The action of the chemicals is not necessarily in direct proportion to the concentration.

5. See also the studies by R. C. Ernst, A. L. Chaney, I. Lavine, E. L. McMillen, E. B. Ayers, N. Bekkedahl, M. Donauer, R. W. Krantz, H. L. Luft, E. W. Nelson, I. J. Redmann, A. G. Zima, and R. E. Brewer (the last-named under the Division of Technological Chemistry).

RALPH E. MONTONNA, Ph.D., Assistant Professor of Chemical Engineering.

1. (With Harold Hibbert.) The Use of Silicon Tetrachloride for the Preparation of Acyl Chlorides. *Journal of the American Chemical Society*. (In press.)

The purpose of this investigation was to study the action of silicon tetrachloride on anhydrous acids and to determine its availability for use as a method of preparing acid chlorides. Various anhydrous acids in as pure a state as possible were used such as acetic, propionic, butyric, isobutyric, benzoic, phenyl-acetic, sebacic, oxalic, malonic, maleic, pyruvic, and orthonitrobenzoic. The acid was mixed with a suitable solvent (toluene, benzene, or ether) depending on its boiling point and that of the acid chloride and heated to the optimum temperature (usually 50 to 100° C.) and the silicon tetrachloride run in. The reaction takes place as follows:



The method was successful with the straight aliphatic and aromatic acids and such dibasic acids as have the two carboxyls separated by three or more carbon atoms. It did not prove to be successful with dibasic acids where the two carboxyls are closely adjacent, or with ketonic or orthonitro substituted aromatic acids. Yields vary with the different acids from 36 to 87 per cent of theory. The products are characterized by the absence of phosphorus, sulfur, or other compounds capable of exerting deleterious catalytic effects.

2. Preparation of Acetyl Chloride from Glacial Acetic Acid and Silicon Tetrachloride in a Semi-commercial Scale Plant. *Industrial and Engineering Chemistry*. (In press.)

The laboratory process reported in the preceding abstract was studied in a semi-commercial scale plant and the optimum conditions for the preparation of acetyl chloride determined. A twenty-five gallon steam jacketed steel autoclave equipped with a stirrer, feed pipe, thermometer pocket, and the necessary condensing system together with an absorption system for the hydrochloric acid was used for these experiments. Fifty degrees Centigrade was found to be the best temperature and toluene the best solvent. The best yields were secured when the  $\text{SiCl}_4$  was fed in as rapidly as possible. The charges were of such size as to yield fifty lbs. of acetyl chloride. The best yields averaged around 80 per cent of theory and the process seemed to offer possibilities of commercial use where the raw materials for making  $\text{SiCl}_4$  (chlorine and waste silicon carbide) were cheaply obtainable.

3. (With Harold Hibbert.) Thermolysis of Benzyl Benzoate.

This investigation was undertaken to study the conditions of decomposition of benzyl benzoate by heat and the catalytic influence of iodine upon this reaction. Benzyl benzoate was heated for 72 hours in a flask under an atmosphere of  $\text{CO}_2$  at a temperature just below its boiling point (195-215° C.). The flask was so arranged that any lower boiling decomposition products would distill over. The decomposition was small (not more than 10 per cent) and after 72 hours no further change was noted. Benzaldehyde and benzoic acid together with unchanged benzyl benzoate were found and definitely identified among the products and tests were obtained for toluene and benzoic anhydride but the latter were present in such small amount that confirmatory tests were not obtained. This decomposition of benzyl benzoate is facilitated in a remarkable manner by a trace (0.01 per cent) of iodine.

4. (With Harold Hibbert.) A New Method for the Preparation of Benzoyl Chloride.

A new method for the preparation of benzoyl chloride has been worked out which consists in the action of chlorine at elevated temperatures on anhydrous benzyl benzoate. The raw material for these experiments consisted in benzyl benzoate, both

crude reaction product from the Schotten-Baumann reaction and pure redistilled ester. The method consisted in heating benzyl benzoate to about 200° C. in a distilling flask connected to an air condenser and a receiver and passing in chlorine from a cylinder until all of the benzyl benzoate was used up. The product was then redistilled.

Yields of 95-98 per cent of theory were obtained. The product seemed to be a very pure acid chloride without traces of ring-chlorinated derivatives and free from the ester. This offers a direct means of converting benzyl chloride into benzoyl chloride since the former can readily be hydrolyzed to the alcohol which can be converted into the ester with benzoyl chloride by means of the Schotten-Baumann reaction. Two molecules of the acid chloride are produced per molecules of ester and one of these is returned to react with more alcohol. The procedure outlined offers an easy laboratory method for the preparation of pure benzoyl chloride and readily lends itself to the utilization of a continuous process in the plant on account of the widely differing boiling points of benzyl benzoate (323° C.) and benzoyl chloride (198° C.).

#### 5. (With Harold Hibbert.) An Attempt to Prepare A Four-membered Cyclic Acetal—The Addition of Aldehydes to Chloral.

It was desired to prepare a four-membered cyclic acetal of the type:



in order to study its properties in connection with another investigation of a theoretical nature. This could be done by causing an aldehyde to undergo acetalysis with a gem. glycol, i.e., one in which the two hydroxyl groups are attached to the same carbon atom. Chloral hydrate is a glycol of this type and trimethyl acetaldehyde was chosen as the aldehyde because the electro-chemical character of the attached groups was opposite to chlorine. When the two are mixed in equimolecular proportions in the presence of a trace of concentrated sulfuric acid a reaction takes place giving a white crystalline derivative which on recrystallization from absolute alcohol has a melting point of 114° C. It is an extremely stable substance, being unaffected by ordinary reagents either hot or cold. Analysis and a molecular weight determination show it to consist of two molecules of trimethyl acetaldehyde and one of chloral. The same substance is obtained when a mixture of chloral itself and the aldehyde are allowed to react without a catalyst. The question of its structure is being investigated.

#### 6. Studies on Filtration. (See abstract under E. E. Jewett.)

ROBERT C. ERNST, M.S. (Ch.E.), Instructor in Chemical Engineering.

Electro-Deposition of a Tri-metallic Alloy. (Thesis for the Ph.D. degree; C. A. Mann, Adviser.)

The alloy under consideration is an improvement over a bi-metallic alloy which is now plated on metals and is used to protect the underlying metals from corrosion. The conditions under which this alloy is best deposited are being studied, such as the composition of the electrolyte, potentials necessary, effect of addition agents, and tests on its corrosion resistance under varying conditions.

ALBERT L. CHANEY, B.A., M.S., Assistant in General Inorganic Chemistry.

Vacuum Distillation of Peat. (Thesis for the M.S. degree; C. A. Mann, Adviser.)

Air-dried peat was distilled in an iron retort at 15 mm. pressure. Tar and aqueous liquor condensed in separate receivers by fractional condensation. Peat yields 7 per cent tar and 15 per cent aqueous distillate. The tar is of waxy consistency and light colored at first. On distillation it gives an oil containing phenols and neutral oils and a saponifiable wax. The residue is pitch. The aqueous liquor is first acidic and later basic during the distillation. The acidity of the aqueous liquor is due, in part, to acetic acid.

IRVIN LAVINE, B.S., Assistant in Chemistry.

A Study of Silica Jells. (Thesis for the degree of M.S. in Chem. Eng.; C. A. Mann, Adviser.)

The possibility of using silica jell as a water softener has been suggested but as yet no work has been done along this line. In the preparation of silica jell dilute solutions of hydrochloric acid and sodium silicate were used. The dilute solution of sodium silicate was slowly added to the solution of hydrochloric acid until the solution has become alkaline. When this point has been reached the silica jell precipitates out, that is, the entire solution becomes a jelly mass. This jelly mass is then dried, washed to remove chlorides, and then dried out once more, the final product being the desired silica jell. Work in progress.

ELLIOTT L. McMILLEN, B.S., Assistant in Chemical Engineering.

Experiments on the Electro-Deposition of Tungsten. (To be offered as a thesis for the degree of M.S. in Chem. Eng.; C. A. Mann, Adviser.)

A method for plating tungsten upon other metals to form a protective coating would be very desirable on account of its great resistance to corrosion even by concentrated acid solutions. This work is a continuance of that by Halvorsan (Thesis, 1923; Chemical Library, University of Minnesota) who successfully plated tungsten on iron using a fused LiCl bath and a soluble tungsten anode. Fused baths of (1) LiCl-KCl eutectic mixture and (2)  $ZnCl_2$  are being investigated with the hope of using a lower temperature. Only one experiment in twenty-two has so far been successful and that from a fused LiCl bath. The optimum conditions for the plating of tungsten from fused baths have not yet been fully determined. The use of  $WCl_6$  dissolved in pure acetone (dry) is also under investigation.

ELLSWORTH B. AYERS, Undergraduate Student.

Determination of the Thickness of Oil Films in Bearings and the Relation to the "Oiliness" of the Oil. (Thesis for the degree of B.S. in Chem.; C. A. Mann, Adviser.)

Three methods were used. A pile of 250 thin metal plates was measured with a micrometer. The plates were wet with oil and again measured. The increase was due to the oil films. The methods give only approximate results. Use was made of a conical bearing fitted with a micrometer attachment that permitted measurement of the diagonal thickness of a single film. This was the most successful method and good results were obtained. Finally, measuring the electrical capacity of the oils was tried. Under the pressures used in bearings, the resistance of the films was so low that the capacity effect was of no value. Hence this method was given over. The conclusions are that oil films may be measured and the oils in question may be evaluated on the basis of the thickness of the adsorbed films that they are capable of forming.

NORMAN BEKKEDAH, B.S., Graduate Student.

Some Investigations on Lithopone. (To be offered as a thesis for the M.S. degree; C. A. Mann, Adviser.)

The purpose of this research is to try to prepare lithopone by a new method. Barium sulphate is ground in a ball mill with barium sulphhydride until a positive colloid is formed. Zinc sulphide is also ground in the ball mill with barium sulphhydride until a negative colloid is formed. By the grinding of these two mixtures together, lithopone will be prepared. Up to the present time, only the barium sulphate colloid has been prepared, and found to be positive.



MAX DONAUER, B.S., Chem. Eng., Graduate Student.

Some New Applications of Vacuum Processes in Food Manufacturing. (Thesis for the Chem. Eng. degree; C. A. Mann, Adviser.)

Many food products in the processing by the application of heat darken in color, lose their delicate flavors, and have an undesirable structure. When this processing is done under vacuum the effect of higher temperature is eliminated. This investigation concerns itself with the following: (1) the manufacture of jams, preserves, and jellies under vacuum; (2) a study of jelly formation under vacuum; (3) the manufacture of fruit syrups under vacuum; (4) new types of vacuum evaporators for food products.

DONALD E. EDGAR, B.S., M.S. in Chem. Eng., Assistant in Chemistry.

An Investigation of Certain Derivatives of Citronellal. (Thesis for the degree of M.S. in Chem. Eng.; G. B. Frankforter, Adviser.)

Preparation and determination of physical constants of citronellol, methyl citronellol, ethyl citronellol, propyl citronellol, butyl citronellol, isoamyl-citronellol, isopulegol, isopulegol acetate, polymer of isopulegol and electrolytic oxidation product of citronellal from citronellal.

ERNEST E. JEWETT, B.S., Undergraduate Student.

Studies on Filtration. (Thesis to be offered for the degree of M.S. in Chem. Eng.; R. E. Montonna, Adviser.)

The various proposed filtration equations have been subjected to critical analysis and that of Lewis and Almy chosen as being the most practicable for use in chemical engineering work. The best methods for the determination of the constants in this equation have been selected. The filtration constants for calcium carbonate and calcium sulfate sludges have been worked out under varying conditions. A study has been made of the effect of viscosity and surface tension of the filtrate on the values of the constants. The variations of the constant  $K$  with concentration of sludge have been studied. Microphotographs showing the peculiar structure of the calcium sulfate cake have been obtained.

RUDOLPH W. KRANTZ, B.A., M.S. in Chem. Eng., Research Fellow in the Engineering Experiment Station.

Experiments on the Utilization of Waste Sulfite Liquors. (Thesis for the degree of M.S. in Chem. Eng.; C. A. Mann, Adviser.)

The raw material used was the sulfite liquors obtained from the calcium bisulfite process on spruce wood in the manufacture of wood pulp. A study of the methods of isolating lignin from the sulfite liquor was made, either directly from the liquor, or as a lignin derivative. Purification of the liquor by precipitation with lime and treatment of the filtrate with carbon dioxide failed completely to remove the inorganic impurities. The preparation of a chlorinated derivative of lignin by passing chlorine through an aqueous solution of the purified liquor produced a product with less inorganic impurities. Chlorinating the original sulfite liquor with active chlorine prepared from the interaction of potassium chlorate on hydrochloric acid solution gave a direct method of separating lignin from the sulfite liquor as a chlorinated derivative relatively free from impurity. The conditions for this chlorination have been worked out and the properties of the chlorinated product have been studied. A chlorine analysis showed 17.7 per cent of chlorine present, which would correspond to a lignin molecule containing four or five chlorine atoms, depending on the formula for lignin that was assumed. The effect of the chlorination was to split off the sulfonic acid group in the original lignin present in the sulfite liquors as shown from the small percentage of sulfur found in the chlorinated product.

HANS L. LUFT, B.S., M.S. in Chem. Eng., Graduate Student.

The Electrolytic Preparation of Lithium Hydroxide and Lithium Hypochlorite. (Thesis for the degree of M.S. in Chem. Eng.; C. A. Mann, Adviser.)

Lithium hydroxide which is used in Edison storage batteries has commonly been made by long chemical methods. Because the related hydroxides of sodium and potassium are made electrolytically it seemed feasible to apply this method to the preparation of lithium hydroxide. Lithium hydroxide of 96.22 per cent purity was obtained from the chloride using graphite anodes with nickel wire cathodes and separating the catholyte from the anolyte by an unglazed earthenware porous cup. Current density, 1.1117 amperes per square decimeter. Lithium chloride is produced with a current density of 10 amperes per square decimeter using graphite electrodes at 15° C. with continuous agitation. Current efficiency 60 per cent.

ERNEST W. NELSON, B.A., M.S. in Chem. Eng., Graduate Student.

The Electrolytic Preparation of Barium Hydroxide from Barium Sulphide. (Thesis for the degree of M.S. in Chem. Eng.; C. A. Mann, Adviser.)

Barium hydroxide is made from barium sulphate by reducing to the sulphide and this in turn is converted to the carbonate which in turn is calcined to the oxide. From the oxide the hydroxide is ordinarily made. The electrolytic method is a direct process from the sulphide to the hydroxide. By using a porous cup diaphragm with a solution of barium sulphide as catholyte and barium nitrate as anolyte barium hydroxide is obtained in high concentration in the cathode chamber. Barium hydroxide of 96 per cent purity can be obtained by crystallization from the cathode liquor. Graphite electrodes are satisfactory. The barium nitrate anolyte prevents the anode from becoming coated with sulphur.

IRVIN J. REDMANN, Undergraduate Student.

The Determination of a Coking Coal. (To be offered later as a thesis for the degree of M.S. in Chem. Eng.; C. A. Mann, Adviser.)

The purpose of this problem is to treat any small sample of coal and by the results to predict whether the coal will form a suitable coke when coked in ovens. It is also desirable to ascertain the quality of the coke produced as, for example, its degree of coherence, the amount of volatile matter left in the coke, ash content, heating value, and reaction to prolonged exposure to air, etc. The finely powdered sample of coal was heated in a small retort of fire clay by means of five blast lamps. Small holes in the cover of the retort allowed the volatile matter to escape. Time of heating was ten hours. The clay retort proved unsatisfactory since it cracked easily with changes of temperature. It was also found that too much heat escaped when the blast lamps were used for heating. It is probable that the next step will be the use of an electrically heated iron retort.

ALBERT G. ZIMA, B.S., Graduate Student.

Investigation of Anode Protection in Hypochlorite Cells. (To be offered as a thesis for the degree of M.S. in Chem. Eng.; C. A. Mann, Adviser.)

Purpose: An attempt to increase the hypochlorite yield in hypochlorite cells by means of lessening the oxidation of the product at the anode. This oxidation results in the loss of final product and disintegration of the anode. Several types of electrodes and cells were designed and are being operated under various conditions. The first set of cells consisted of hollow carbon cylinders with positive and negative sides. These parts were insulated from each other with rubber. The electrolyte was passed through

the cells at different speeds and at different current densities and voltages. Excellent current efficiencies were obtained, but concentration of final product was only about one third that of commercial cells. At present a hollow carbon electrode is being used in an ordinary cell. Hydrogen gas is passed through under various conditions, with and without the use of catalytic agents. No positive results have yet been obtained.

## GENERAL INORGANIC CHEMISTRY

M. CANNON SNEED, Ph.D., Professor of General Inorganic Chemistry and Chief of the Division.

See abstracts listed under L. J. Weber and H. R. Freche.

LILLIAN COHEN, Ph.D., Assistant Professor of General Inorganic Chemistry.  
Quantitative Separation of Columbium and Tantalum.

Separation of columbium oxide from tantalum oxide, by reduction of the columbium oxide in the presence of tantalum oxide by means of the Jones reductor. Reoxidation of the reduced columbium oxide by oxidizing reagent. Determination of the magnetic susceptibilities of these oxides by means of the magnetic balance. Conclusions not drawn as yet, as the separation is difficult and tedious.

RAYMOND E. KIRK, M.S., Assistant Professor of General Inorganic Chemistry.

1. Colloidal Character of Asphalts. First report accepted for publication in the *Journal of Physical Chemistry*.

A study of the colloidal relationships, in natural and fluxed asphalts and its relationship to the use of such materials as cements. It includes observations of the behavior of various asphalts when dispersed in various organic liquids.

2. Studies on Fresh Water Marls of Minnesota. Minnesota Marl. *Chemical Age*, 32:492-93. 1924.

Information has been collected about the conditions under which marl has been deposited. Some samples of unusual marl deposits have been obtained. The evidence substantiates the position previously taken that marl is deposited because of the action of aqueous plants in absorbing carbon dioxide from the lake waters. Information has also been collected concerning the possible uses of marl.

3. Test of a Sodium Reagent.

Uranyl acetate was tested as an analytical reagent for sodium. The results as yet obtained are not such as to indicate its possible use in a scheme of qualitative chemical analysis.

GLADSTONE B. HEISIG, M.S., M.A., Instructor in General Inorganic Chemistry.

1. A Simple Object Test in Chemistry As a Means of Determining Which Students Having Had High School Chemistry Should Be Placed with the Group Not Having Had High School Chemistry.

A simple test on the fundamentals of chemistry was given to students in the engineering, premedical, pre dental, and pharmacy courses in freshman chemistry. The examination consisted of 35 parts contrasted with 122 parts in the Iowa placement test in chemistry. The questions were chiefly of the completion type with a few multiple choice questions. A comparison of grades for the first quarter and the scores obtained in the test indicate some correlation between ability to do creditable work in the advanced course and the score. Grades obtained by the engineering students

who also took the Iowa placement tests in chemistry were compared with the scores on those tests. Results indicate that the writer's quiz consisting of 35 parts gave as reliable results as the Iowa training or aptitude test in chemistry; and that it is not feasible to use these tests in their present form to determine which students who have had high school chemistry should be placed with the beginning group.

## 2. The Reliability of Qualitative Tests for Cations in the Beginner's Hands.

Data which have been collected from different beginning classes under different instructors in qualitative analysis for a number of years seem to indicate that some of the tests used in the identification of certain of the cations, are unsatisfactory in the hands of an inexperienced student in qualitative analysis. Means have been devised to improve the accuracy in such cases. Incomplete data indicate that considerable success has been attained.

## 3. Some New Hydroxamic Acids of the Mono Carboxylic Acids of Pyridine and Quinoline, Their Derivatives and Rearrangements. (Thesis offered for the Ph.D. degree at Princeton University.)

The object of this work is to study the rearrangements of the sodium, potassium, and silver salts of the benzoyl and acetyl derivatives of the hydroxamic acids of the alpha, beta, gamma, mono carboxylic acids of pyridine and quinoline in order to determine the effect of the position of the carboxyl group on the ease of rearrangement of these compounds. The hydroxamic acids and some of their derivatives have been prepared and their rearrangements studied in the case of the alpha and beta pyridine and alpha and beta quinoline hydroxamic acid. Material has been prepared to make the hydroxamic acids of the gamma acids of pyridine and quinoline.

J. LEWIS MAYNARD, B.A., Instructor in General Inorganic Chemistry.

## A Contribution to the Study of the Mechanism of the Action of Mercury with Methyl Iodide. Submitted for publication in the *Journal of the Chemical Society* (London).

This subject is important because of the need for a non-ionized mercury compound for use in conjunction with arsenic derivatives in the treatment of syphilis. Results obtained by the author show that when mercury is allowed to stand in the sunlight with methyl iodide a series of four consecutive reactions results in the formation of the organomercuric derivative, methylmercuric iodide. It has been found that the massive mercury placed with the methyl iodide will not react with it, whereas the metal in finely divided form readily enters into combination with the alkyl iodide. The first two reactions in the series noted above result in the formation of mercurous iodide, a substance which, when photochemically decomposed, yields the necessary mercury in a finely divided state. It has further been shown that ultra-violet light plays no part in the decomposition of mercurous iodide.

HENRY N. STEPHENS, Ph.D., Instructor in General Inorganic Chemistry.

## Oxidations in the Benzene Series by Means of Gaseous Oxygen.

The methyl benzenes are oxidized slowly by gaseous oxygen at 100° to 110° C. yielding corresponding aldehydes and acids and also gummy products which probably result from condensation of the aldehydes. When a hydrocarbon with more than one methyl group is employed only one of these groups is oxidized. Increase in temperature above that given increases the amount of gummy product at the expense of aldehyde and acid and if the temperature be high enough the former is the sole product. The speed of oxidation increases with the increasing number of methyl groups. The ethyl group on oxidation yields as the main product the  $-\text{CO}\cdot\text{CH}_3$  group and also a very small amount of the keto aldehyde group,  $-\text{CO}\cdot\text{CHO}$ . The iso-propyl



group yields the same two classes of products, one methyl group being removed by oxidation to formic acid.

If the water formed in the above reactions be allowed to accumulate, the speed of reaction is reduced. Addition of water at the outset completely inhibits oxidation. The careful drying of both hydrocarbon and oxygen increases the speed of oxidation. The simplest explanation of these facts would be in the assumption that the elimination of water in the course of oxidation is a reversible reaction.

LUDWIG J. WEBER, B.S., Ch.E., Instructor in Metallography.

(With M. C. Sneed.) The Detection of Osmium, Ruthenium, Rhodium, and Iridium. (Thesis for the Ph.D. degree; under the direction of M. C. Sneed.)

Analytical reactions for the platinum metals are listed. Former methods for the analysis of the platinum metals are reviewed and their limitations presented. Our method consists in separating osmium from the other metals by distilling a solution of all of them with sulfuric acid and catching the distillate in a solution of potassium hydroxide to which osmium imparts a bright yellow color. The other metals are precipitated from solution by zinc. They are then fused with potassium bisulfate in which only rhodium dissolves. The residue is fused with potassium chlorate and potassium hydroxide, and the fusion dissolved in dilute hydrochloric acid. The solution is then evaporated. The residue is dissolved in water and treated with sodium sulfide. Ruthenium is precipitated while the iridium remains in solution.

HERTHA R. FRECHE, B.A., M.S., Shevlin Fellow in Chemistry.

A Study of Mercury Aminochloride. (Thesis for the M.S. degree; M. C. Sneed, Adviser.)

The conclusions are as follows: (1) that during the reaction between mercurous chloride and ammonium hydroxide, mercurous oxide is probably formed in addition to mercury and mercury aminochloride; (2) that the black precipitate when extracted with ammonium hydroxide yields two forms of crystals; (3) that dry hydrogen chloride does not affect the black precipitate unless moisture is present; (4) that the black precipitate behaves like mercurous oxide when heated in hydrogen; (5) that ammonia gas does not react with calomel unless moisture is present; (6) that hydrogen chloride does not react with finely divided mercury.

## ORGANIC CHEMISTRY

WILLIAM H. HUNTER, Ph.D., Professor of Organic Chemistry.

1. (With J. T. Tate.) Studies on the Absorption Spectra of Organic Substances in the Vapor State.

This work has been undertaken in the hope that it will be possible to determine the fundamental energy states of the molecule. The absorption spectra are photographed with a quartz spectrograph and analysed with a densitometer obtained through a grant from the Graduate School research fund. Preliminary results have been obtained with benzene vapor which confirm the findings of Victor Henri. Work is still in progress.

2. See also the studies by W. M. Lauer, A. C. Beckel, L. B. Beckwith, T. T. Budrow, M. A. Dahlen, W. S. Dyer, R. E. Jackman, E. I. Kilburn, A. H. Kohlhasse, P. E. Millington, M. L. Morse, Minerva Morse, C. Sly, B. E. Sorenson, F. H. Rathman, and R. B. Whitney.

LEE I. SMITH, Ph.D., Assistant Professor of Organic Chemistry.

1. The Synthesis of Duroquinone.

In connection with another piece of research, large amounts of duroquinone were required. This material has been made only a few times previously, and then always in small amounts. A study of this method for preparing it has led to several improvements resulting in a much better yield. Finished. To be published later.

2. The Reaction between Fully Substituted Unsaturated 1:4 Diketones and Malonic Ester.

The addition of malonic ester to duroquinone is complicated by the fact that oxidation takes place and the product isolated is not the primary reaction product. To eliminate the effect of the quinone ring, malonic ester will be added to a fully substituted unsaturated 1:4 diketone, containing the same system as is present in the para quinones. The synthesis of the diketone is at present in progress, and there are no results to report on the main problem. Unfinished.

3. A Laboratory Ozonizer Producing High Concentrations of Ozone. To be published in the *Journal of the American Chemical Society*, about July, 1925.

When used as a reagent in organic chemistry, ozone must be available in fairly high concentrations. A relatively inexpensive laboratory ozonizer has been constructed, which will yield ozone in ozonized oxygen of a concentration as high as 15 per cent and which is capable of making over four grams of ozone per hour, depending upon the rate at which the gas passes through the apparatus. The generator utilizes the "silent electric discharge" and is made up of three modified Berthelot tubes connected in series. An extensive study has been made of the performance of this apparatus under different conditions.

4. The Effect of Various Reagents upon Ozone. To be published in the *Journal of the American Chemical Society*, about July, 1925.

The reagents investigated fall into two classes with respect to their effects upon ozone: (1) those having a very slight effect. To this group belong water, concentrated and dilute sulfuric acid, water followed by concentrated sulfuric acid, acidified potassium permanganate solution, and phosphorus pentoxide which has been resublimed in a current of oxygen; (2) those having a great effect, and destroying much or all of the ozone. To this group belong 5 per cent sodium hydroxide solution and ordinary phosphorus pentoxide.

5. See also the studies by H. M. Crawford, F. J. Dobrovolny, and Howard Brinker.

WALTER M. LAUER, Ph.D., Assistant Professor of Organic Chemistry.

1. The Action of Iodine on the Grignard Reagent.

The Grignard reagent has been reported to undergo several different reactions when treated with iodine. A quantitative study is being made to determine the extent and nature of these various reactions. It is thought that radicals containing neutral trivalent carbon atoms might be found to play an important rôle in these reactions. A suitable apparatus has been designed for this purpose. Work in progress.

2. The Constitution of Tribromophenolbromide. (Part of a thesis for the Ph.D. degree; W. H. Hunter, Adviser.)

Two formulas have been assigned to the substance obtained when tribromophenol is brominated. One formula represents this substance as a hypobromite, while the other pictures it as tetrabromocyclohexadienone. The problem is to determine

which is correct. It has been found that upon brominating trichlorophenol a compound was obtained which was not identical with the one obtained by chlorinating dichloro-*p*-bromophenol. This eliminates the simple tetrabromocyclohexadienone structure, for according to it, these two compounds should be identical (assuming that no replacement of bromine by chlorine has taken place).

The most logical viewpoint regarding the question is therefore as follows: Tribromophenol bromide is a hypobromite. The compounds obtained by chlorinating are hypochlorites. In case there is bromine in the *para* position these hypochlorites tend to rearrange to form hypobromites with chlorine in the ring.

### 3. Do the Radicals Derived from Optically Active Triarylchlormethanes Exhibit Optical Activity?

It is planned to synthesize biphenyl  $\alpha$ -naphthyl carbinol and then resolve this substance into its optically active components. These active compounds are then to be converted to the corresponding chlormethanes and the free radicals prepared in the regular manner. It is then planned to test these free radicals for optical activity. Information on this point will, it is thought, shed some light on valence problems, and the Walden inversion, as well as problems having to do with reaction mechanisms. Work in progress.

ARTHUR C. BECKEL, B.S., Assistant in Organic Chemistry.

The Decomposition of Aryl Substituted Acetic Acids. (Thesis for the Ph.D. degree; W. H. Hunter, Adviser.)

It is the purpose of this investigation to compare the rates of decomposition with the degree of dissociation of the corresponding hexa-aryl ethanes. Among the acids to be studied are triphenylacetic, diphenylnaphthylacetic, diphenylmonobiphenyl acetic, etc. A suitable apparatus has been constructed for the measurement of the evolved carbon monoxide, and from preliminary investigations the proper conditions and technique have been worked out.

LAWTON B. BECKWITH, B.A., Assistant in Inorganic Chemistry.

The Synthesis and Properties of the Di-(*para* hydroxyphenyl)-Ether of Hydroquinone. (Thesis for the Ph.D. degree; W. H. Hunter, Adviser.)

It is desired to compare the reactions of the above phenol and its substitution products with those of mononuclear phenols and their oxidation products. The starting point is the preparation of the di-(*para* nitro phenyl)-ether of hydroquinone by the interaction of paradibromobenzene and potassium *para* nitrophenolate. The substances to be prepared are all unknown, and methods are being devised for this work. The first two compounds required in the synthesis have been prepared and are in process of identification.

THEODORE T. BUDROW, B.S., Assistant in Chemistry.

The Action of Iodine on Alkali Phenolates. (Thesis for the M.S. degree; W. H. Hunter, Adviser.)

The object of the present work is to discover whether iodine can not be introduced under conditions which preclude the formation of hypoiodous acid, and incidentally to ascertain the presence or absence of other products, the formation of which is suspected. Anhydrous sodium phenolate and anhydrous iodine are allowed to react in different media. A method has been worked out for the preparation of pure anhydrous sodium phenolate, in a current of hydrogen. Preliminary experiments indicate that more than one change occurs.

H. MARJORIE CRAWFORD, M.S., Assistant in Chemistry.

The Reaction between Duroquinone and the Grignard Reagents. (To be offered as a thesis for the Ph.D. degree; L. I. Smith, Adviser.)

The only published work dealing with the addition of the Grignard reagents to simple benzoquinones concerns toluquinone and xyloquinone, both of which contain mobile hydrogen atoms. Because of the presence of these hydrogen atoms, the reaction is complex and leads to many products. To eliminate this effect, duroquinone, a fully substituted quinone, has been used. At least three products result, two solids and a liquid. In addition, gases are liberated during the reaction. The identity of one of the solids has been determined, and the gases have been analyzed, the results indicating that the gaseous product is a mixture.

MILES A. DAHLEN, B.S., Assistant in Chemistry.

The Synthesis and Properties of Parahydroxy-Diphenyl-Ether. (To be offered as a thesis for the Ph.D. degree; W. H. Hunter, Adviser.)

It is desired to study the effect produced on the properties of phenol, by the introduction of a phenoxy group. The chief importance of this work is in its connection with the formation of amorphous products from the halogenated phenols, since these compounds contain many benzene rings united by ether ties. The synthesis of the desired substance is in progress, starting from para iodonitro benzene, which is condensed with potassium phenolate in phenol solution. The various stages of the reaction are subject to considerable technical difficulties, so that amounts of the ether sufficient for study have not yet been obtained.

FRANK J. DOBROVÓLNY, M.S., Assistant in Chemistry.

1. The Methylation of Xylene. (Thesis for the M.S. degree; L. I. Smith, Adviser.)

It was desired to obtain a convenient and cheap method for preparing, in quantity, durene, one of the tetramethyl benzenes. The reaction chosen for this purpose was the direct methylation of xylene, using methyl chloride and aluminum chloride as reagents. A study has been made of the conditions leading to the maximum yield of durene, and several kilos of this material have been made. Finished.

2. The Reaction between Duroquinone and Malonic Ester. (Thesis for the Ph.D. degree; L. I. Smith, Adviser.)

Due to the presence of mobile hydrogen atoms in the quinone system, the addition of malonic ester to the system is very complex and results in mixtures from which it is not possible to isolate any definite products. To eliminate the effects of these mobile hydrogen atoms, duroquinone, a completely substituted quinone, has been used. When sodium malonic ester is added to duroquinone in an inert solvent, only one solid product results. Some thirty derivatives have been made of this addition product, all of them analyzed and their approximate molecular weights determined. To date it has not been possible to assign a definite structure to any of them, and no formula, so far proposed, can be correlated with all of the experimentally determined facts. Unfinished.

WALTER S. DYER, B.S., Assistant in Chemistry.

The Action of Iodine on the Alkali Salts of Oximes. (Thesis for the M.S. degree; W. H. Hunter, Adviser.)

The object of the research is to compare the action of iodine on the system,  $\text{NaON}=\text{C}-\text{C}=\text{NOR}$  with its action on the system  $\text{NaOC}\equiv\text{C}-\text{C}\equiv\text{C}-\text{X}$  which appears in the halogenated phenols. Salts of monoximes and diioximes are prepared in the anhydrous condition, and treated with dry iodine in indifferent solvents. The



main object so far has been to study the conditions and technique necessary for the quantitative working out of the reaction.

ROSCOE E. JACKMAN, B.A., Assistant in Chemistry.

A Study of the Condensations of Para Phenylaminobenzophenone.  
(Thesis for the M.S. degree; W. H. Hunter, Adviser.)

The benzoylcarbazole prepared by Darling (Master's thesis, 1924; unpublished) shows a condensation reaction, under the influence of phosphorus oxychloride, which is apparently due to the proximity in space of the carbonyl group in one benzenoid ring, to the para hydrogen in the other benzenoid ring. It seems of interest to ascertain whether or not this reaction is independent of the formation of the indol ring. The para phenylaminobenzophenone has been prepared in a pure state, and the effect of numerous condensing agents is being studied. Phosphorus oxychloride produces a condensation, the product of which resembles the one obtained from the carbazole derivative, in certain properties. It is not possible at the present time to state that it is a parallel product.

ELSIE I. KILBURN, B.A., Assistant in Chemistry.

The Geometric Isomerism of 1-Betabromofuryl-2-Bromoethylene.  
(Thesis for the M.S. degree; W. H. Hunter, Adviser.)

An abortive attempt to prepare a benzene ring containing an oxygen bridge by the action of metals on the above compound led to the conclusion that the failure of the reaction was due to the stereochemistry of the system. Accordingly, it seemed worth while to study this factor, before making further attempts at solution of the original problem. The preliminary study of the literature has been made and the laboratory work started.

ARTHUR H. KOHLHASE, Ph.D., Formerly Assistant in Chemistry; now Research Chemist, Roessler Hasslacher Chemical Co.

1. The Action of Phosphorus Pentabromide on Aryl Sulfonic Acids.  
(Part I of thesis for the Ph.D. degree; W. H. Hunter, Adviser.)

In an attempt to prepare a sulfonyl bromide, it was unexpectedly discovered that the main product of the reaction was a disulfide of the aryl radical. The free sulfonic acid or its sodium salt was warmed with freshly prepared phosphorus pentabromide, and the products were determined. It was shown that this is a very general reaction of sulfonic acids. It involves a formation of a sulfonyl bromide, and the reduction of this to a disulfide by the phosphorus tribromide present. This tribromide is supplied by the dissociation of the pentabromide, and is converted into phosphorus oxybromide.

2. The Action of Halogens and of Alkyl Halides on the Salts of Tribromothiophenol. (Part II of thesis for the Ph.D. degree.)

The comparison of the action of salts of tribromothiophenol with salts of tribromophenol, for the purpose of ascertaining the effect of the sulfur atom. The behavior of the thiophenol salts is entirely different from that of the phenol salts. The alkyl halides give no "abnormal" reaction. The halogens yield the disulfide. There is no tendency toward loss of halogen from the ring.

3. The Dissociation of Aryl Disulfides. (Part III of thesis for the Ph.D. degree.)

The determination of the presence or absence of a free radical containing univalent sulfur, in solutions of certain aryl disulfides. The disulfides resulting from the work described in preceding abstracts were used. Molecular weight determinations

indicate appreciable dissociation. Chemical evidence indicates the absence of dissociation. It is concluded that molecular weight determinations are not reliable in investigations of this type.

PAUL E. MILLINGTON, B.A., Assistant in Chemistry.

The Constitution of a Certain Colorless Oxidation Product of 3, 4, 5-Tribromopyrogallol-2, 6-dimethylether. (Under the direction of W. H. Hunter.)

In the work on the oxidation products of the pyrogallol ether mentioned above (Levine, unpublished Ph.D. thesis), a colorless material was isolated in small amount, as a by-product. The problem involved in the present work is the preparation of larger amounts of this material, and the determination of its constitution. The particular oxidation being studied is carried out by the use of chromium trioxide in 50 per cent acetic acid. It has been found possible to increase the relative amount of the desired substance formed in the reaction to such an extent as to make it possible to obtain sufficient material for our purpose. This has been done by increasing the temperature to 80°. The constitution work is now under way.

MARY L. MORSE, M.S., Assistant in Chemistry.

The Oxidation of Triiodophenol. (Thesis for the Ph.D. degree; W. H. Hunter, Adviser.)

It is desired to ascertain whether the presence of iodine in the nucleus will cause the oxidation to proceed in the same direction as does the oxidation of trichlorophenol and the dimethyl ether of 3, 4, 5-tribromopyrogallol, both of which have been examined in this laboratory. (Unpublished Ph.D. theses of A. H. Levine and Minerva Morse.) Triiodophenol is prepared by any of the standard methods, and is subjected to the action of suitable oxidizing agents under varying conditions. Thus far, the action of nitrous acid has been best studied. It yields a product which contains nitrogen, and does not offer any analogies with the products obtained from the other two phenols mentioned above. It is possibly 2 nitro 4, 6 diiodophenol.

MINERVA MORSE, Ph.D., Formerly Assistant in Chemistry; now Research Assistant in Pediatrics.

The Oxidation of Trichlorophenol. (Thesis for the Ph.D. degree; W. H. Hunter, Adviser.)

Monatomic phenols which do not contain halogens give oxidation products which belong, in general, to one of the following classes of compounds: mononuclear quinones, dinuclear quinones, or free radicals. From the point of view of work done in this laboratory, it seemed important to determine the effect of the presence of halogen atoms on the course of the oxidation, with especial reference to its removal from the ring. Pure trichlorophenol was oxidized with nitrous acid, chromic acid, and lead dioxide under varying conditions. It was found that the presence of halogen determines the formation of an entirely new class of oxidation products, the type substance being 2-chloro-6-trichlorophenoxy-parabenzquinone. The formation of these products can be most easily explained by assuming that the first product of the reaction is the free radical containing univalent oxygen, which is postulated as being formed in other reactions of these halogenated phenols.

CARYL SLY, M.S., Assistant in Chemistry.

The Synthesis and Decomposition of Aklylene Iodides. (Thesis to be offered for the Ph.D. degree; W. H. Hunter, Adviser.)

The addition of chlorine and bromine to double bonds is practically irreversible. However, the addition of iodine is reversible. This fact should allow the study of the reaction velocities of the opposing reactions, and the equilibria reached under varying

conditions. It is especially desired to obtain information as to the state of the ethylene and iodine molecules at the time of addition, and to examine the effect of radiations. The present point of attack is the action of iodine on trimethylethylene, since the equilibrium in the case of ethylene seems to be far on the side of the decomposition. Work in progress.

BEN E. SORENSON, M.S., Assistant in Chemistry.

The Action of Phosphorus Pentabromide on Aliphatic and Heterocyclic Sulfonic Acids. (Thesis to be offered for the Ph.D. degree; W. H. Hunter, Adviser.)

The work of A. H. Kohlase (Ph.D. unpublished thesis, 1924) shows that aromatic sulfonic acids are largely reduced to disulfides by phosphorus pentabromide, instead of yielding the expected sulfonyl bromides. It is the purpose of this work to compare the action of this reagent on sulfonic acids of the aliphatic and heterocyclic series. So far, there have been investigated, ethylsulfonic acid and the alpha sulfonic acid derivative of betaphenylpropionic acid. Other materials are being prepared. The ethylsulfonic acid yields 70 per cent of the normal product, the sulfonyl bromide. No disulfide can be found in the product. The substituted phenylpropionic acid gives a most unexpected result, since there is formed about 60 per cent of alpha beta dibromo beta phenyl propionic acid.

HOWARD BRINKER, Undergraduate Student.

The Purification of Solvents. (Thesis for the B.S. degree; under the direction of L. I. Smith.)

Many methods have been published for the purification of various solvents and it is often difficult to decide upon the best method to use in any given case. A study and comparison of the methods available has been undertaken. Three solvents (benzene, carbon bisulfide, and pyridine) have been studied and for the first two of these quick, cheap, and convenient directions for purifying them have been worked out. The third one is still under investigation.

FRANZ H. RATHMAN, B.A., Graduate Student.

A Comparison of Different Groups, with Regard to the Ease of Removal from the Benzene Nucleus. (Thesis for the M.S. degree; W. H. Hunter, Adviser.)

The most striking phenomenon presented by the catalytic decomposition of halogenated phenol salts, is the removal of halogen from the ring. It is of great importance to discover whether this is a property of the halogen atoms only. The evidence adduced by the work on phenol oxidations is contrary to this view, hence it becomes necessary to check this by carrying out actual catalytic decompositions of silver salts bearing suitable groups in the para position. The action of undiluted ethyl iodide and of traces of iodine will be tried on the silver salts phenols containing bromine in the 2,6 positions, and the groups to be studied, in the 4 position. The first phenol chosen for study was the monomethyl ether of tetrabromohydroquinone. The silver salt of this phenol is very sensitive to oxidation, and it has not yet been prepared in a sufficiently pure state.

ROBERT B. WHITNEY, B.A., Graduate Student.

Studies on the Mechanism of the Decomposition of Halogenated Phenol Salts. (Thesis to be offered for the Ph.D. degree; W. H. Hunter, Adviser.)

The most striking phenomenon in the course of the catalytic decomposition of halogenated phenol salts, is the appearance of a blue or a green color, which disappears more or less rapidly, according to the nature of the phenol. In view of the fact that the working hypothesis now in use in this laboratory for the course of the reaction,

involves the intermediate formation of free radicals, it becomes important to determine whether this evanescent color is not due to such a free radical. The salts of halogenated phenols are being examined while being decomposed catalytically, while being oxidized by iodine, and while being electrolyzed. Evidence has been collected, which points to the blue or green color as actually the color of a free radical.

## PHYSICAL CHEMISTRY

FRANK H. MACDOUGALL, Ph.D., Professor of Physical Chemistry.

1. (With R. G. Green.) Theory of Electrical Conductance of Inhomogeneous Systems with Application to Systems of Blood Cells. *Journal of Infectious Diseases*, 36:330-39. 1925.

The mathematical theory has been developed to a considerable extent and application made to such systems as suspensions of blood cells, bacteria or yeast cells in salt solutions. It has been shown by this work that it is possible to determine the effective electrical resistivity of biological cells as their dimensions by electrical measurements. The results throw some light on the problem of the permeability of such cells.

2. (With R. G. Green.) A Study of the Ring-Method of Determining Surface Tension. To be published in *Science*.

The general purpose of this work is to discover a method of measuring the important property of surface tension by a convenient and accurate method. Some recent users of the method seem to have overlooked some of the fundamental results already well established by the investigations of Max Cantor. We have shown experimentally that the maximum pull on the ring depends not only on the radius of the ring, but also very markedly on the diameter of the wire used in making the ring.

3. Amplification of Debye's Theory of Electrolytes. To appear in a new edition of MacDougall's *Thermodynamics and Chemistry*.

LLOYD H. REYERSON, Ph.D., Assistant Professor of Physical and Inorganic Chemistry.

1. Metallized Silica Gels and Their Catalytic Activity. Read before the Third National Colloid Symposium, June, 1925.

The purpose of the investigation is to determine the catalytic activity of metals deposited in a minute state of division upon a porous surface. The investigations which have been started are studies concerning the catalytic effect of these metallized gels upon organic oxidations and reductions. A rather broad study of these reactions will be made. Part of this work is being carried on under his direction by V. N. Morris and L. E. Swearingen, who are candidates for the Ph.D. degree.

2. (With Max Latshaw.) The Reducing Action of Hydrogen Adsorbed in Silica Gel. *Journal of the American Chemical Society*, 47:610. 1925.

VLON N. MORRIS, M.S., Assistant in Physical Chemistry.

Metallized Silica Gels. (To be used as a thesis for the Ph.D. degree; see abstract by L. H. Reyerson, Adviser.)

RALPH F. BEARD, B.S., Assistant in Physical Chemistry.

The Average Life of Mesothorium. (To be offered as a thesis for the Ph.D. degree; L. M. Henderson, Adviser.)

Ms 1 is a radioactive element similar to radium. The rate of decay of the radioactivity of Ms 1 can not be measured directly. The activity of Ms 2, a decay



product of  $M_s 1$ , can be measured, and inasmuch as the rate of growth of  $M_s 2$  is a function of the average life of  $M_s 1$  and the average life of  $M_s 2$ , the average life of  $M_s 1$  can be calculated as that of  $M_s 2$  which is definitely known. The activity of solutions, of known age and history, containing  $M_s 1$  are measured. Likewise the activity of thorium minerals containing the equilibrium amount of  $M_s 1$  are measured and from the data thus obtained the average life and half period of  $M_s 1$  can be calculated. Work in progress.

### TECHNOLOGICAL CHEMISTRY

EVERHART P. HARDING, Ph.D., Associate Professor of Technological Chemistry.

A Determination of the Quantitative Distribution of the Different Forms in Which Sulphur Exists in Oil Shale and Its Quantitative Distribution in the Distillation Products.

The purpose of the investigation is the production of a shale oil of better quality that can be more highly refined.

RALPH E. BREWER, M.S., Instructor in Technological Chemistry.

The Measurement of Hydrogen Ion Concentration of Plating Solutions with Oxygen and Air Electrodes. (Thesis for the Ph.D. degree; under the direction of C. A. Mann.)

In both nickel and cobalt plating baths the acidity of the bath determines the success or the failure of the resulting deposit. No satisfactory method is now available to follow this acidity during the operation of plating. The oxygen and the air electrodes have proven useful in this connection but are slow. Several types of electrodes have been tried and these compared with colorimetric methods.

# THE COLLEGE OF EDUCATION

## AGRICULTURAL EDUCATION

ASHLEY V. STORM, Ph.D., Professor and Chairman of the Department of Agricultural Education.

See studies by C. Manikowski and R. B. Smith.

FRANK W. LATHROP, M.S.A., Associate Professor of Agricultural Education.

### 1. An Analysis of the Oat Growing in Minnesota.

The purpose of this study is (a) to work out a method of analyzing farm jobs; (b) to collect for the use of teachers of agriculture in Minnesota the experience of farmers in growing oats. The study is based on individual conferences with forty-one farmers in four type areas in Minnesota. Further work is necessary before the study can be brought to a conclusion.

2. See also the studies by I. Montgomery, F. E. Moore, and A. H. Olesberg.

ALBERT M. FIELD, M.S., Assistant Professor of Agricultural Education.

### 1. Farm Shop Work in the Program for Vocational Agriculture in the Secondary Schools. (To be published.)

The conclusions are as follows: (1) All but two states offer farm shop work. (2) There is no uniformity in the organization for shop work. (3) Approximately 40 per cent of the time devoted to vocational work is used for shop instruction. (4) The agriculture work is usually given Monday, Wednesday, Friday and the shop work on Tuesday and Thursday, or the shop work is given at irregular periods. (5) There is a tendency toward the practice of selecting farm shop exercises to meet the needs of individual students. (6) The teachers of agriculture are not well trained for shop instruction. (7) There is a tendency to get away from prescribed state courses. (8) There is a definite tendency to get away from the formal manual training type of shop work. (9) There is a growing tendency to devote more time to repair work. (10) Many states advocate the building of farm shops on the farm. (11) The formal shop courses are disappearing. (12) Drawing should be taught from the utility rather than the artistic point of view and should enable the pupil to get the thought from the drawing the same as he does from the printed page.

### 2. The Training of Teachers for Farm Shop Work. (To be published.)

From the data collected, the following conclusions are drawn: (1) Nine states make no special provision for training teachers for shop work. (2) There is a slight tendency toward special methods courses in farm shop. (3) Most states have provided special training in farm shop work for prospective teachers. (4) The present requirement is about an average of three (range 0-9) courses in farm shop. (5) The range in credits is from 0 to 16 semester hours. (6) There is a decided tendency to base content of courses for teachers on what is to be taught in the high schools. (7) Very few students preparing to become teachers elect the mechanical courses. (8) The highly specialized mechanical courses found in colleges of agriculture are not well adapted to meet the needs of the secondary school teacher. (9) Rigid prescribed curricula prevent some students from getting needed shop training. (10) Demand for better training from men in the field will facilitate changes in colleges.

### 3. Status of Supervision As a Function of State Departments of Education.

The purpose of the study is to learn to what extent the members of the state departments attempt to supervise classroom teaching, or what is done to improve teachers in service. Work in progress.

### 4. The Supervision of the Teaching of Vocational Agriculture. (To be offered as a thesis for the Ph.D. degree in Cornell University.)

The purpose of the study is to analyze present practices in supervision for vocational agriculture with the view of setting up a more functional program and technique. Work in progress.

### 5. See also the study by V. E. Nylin.

VICTOR E. NYLIN, M.S., Instructor in Agricultural Education.

A Study of the Status of Agricultural Education As Analyzed through a Study of the State Board Examinations. (Thesis for the M.S. degree; A. M. Field, Adviser.)

The purpose of the problem is to determine the status of agricultural instruction in Minnesota through an analysis of the State Board of Education examinations and questionnaires from thirty schools of the state. It is found that the Smith-Hughes departments tend to dominate the type of instruction in the state. Other schools not maintaining special departments were found to offer a general course, academic in nature. For the five-year period there was a decline in all schools offering courses in agriculture, excepting Smith-Hughes departments. The State Board examinations formed the basis for the course of study in schools other than State-aided or Smith-Hughes departments.

SHERMAN DICKINSON, M.A., Instructor in Agricultural Education. Professor of Agricultural Education, University of Missouri.

An Occupational Analysis of the Work of the Dairy Farmer. (To be offered as a thesis for the Ph.D. degree; M. E. Haggerty, Adviser.)

This study has identified more than one thousand separate items of information regarding problems and practices in dairying, knowledge of which is deemed to be necessary for success in dairy farming. These items cover the following fields: (1) importance of dairy husbandry; (2) dairy type and breeds; (3) starting the dairy herd and business; (4) selection of individuals; (5) breeding of dairy cattle; (6) calf raising; (7) development of dairy heifer; (8) care and management of dairy heifer; (9) feeding for milk production; (10) maintaining health of herd; (11) dairy barns, silos, other structures; (12) farm dairying and handling product; (13) business aspects of dairy farming. These items have been submitted to a selected group of dairy experts for judgment as to their importance. They have been thrown into test form and have been submitted to farmers, dairymen, teachers, and students in school with a view to determining the extent of existent knowledge in the field and the relative difficulty of the several items for pupils. Work in progress.

CECILE MANIKOWSKI, B.S., Graduate Student.

Organization, Management, and Standards of Summer Camps for Rural Girls. (To be offered as a thesis for the M.S. degree; A. V. Storm, Adviser.)

The purpose of this study is to determine from the experience of persons who have conducted camps for rural girls the desirable standards and the technique of organizing and managing such camps. A questionnaire is to be sent to persons in various states who have actually conducted such camps.

IRA MONTGOMERY, B.S., Graduate Student.

A Standardized Information Test in Corn Growing. (Thesis to be offered for the M.S. degree; F. W. Lathrop, Adviser.)

The purpose of this problem is to construct a standardized test which will measure certain results from the teaching of corn growing. A large number of questions of the various types is being collected. These will be submitted to students in high school departments of agriculture so that norms may be obtained.

FORREST E. MOORE, B.A., Graduate Student.

Methods of Securing Enrollment and Publicity for the Agriculture Department in the High School. (Thesis to be offered for the M.S. degree; F. W. Lathrop, Adviser.)

The purpose of the study is to discover what methods teachers of agriculture have found successful for recruiting of desirable students and for obtaining legitimate publicity. A questionnaire is being sent to teachers of agriculture in about twenty states. Also a card is to be made out by each student in departments where questionnaires are sent. On this card the student will be asked to indicate what factors influenced him in deciding to enroll in the agriculture department.

ALBERT H. OLESBERG, B.S., Graduate Student.

An Analysis of the Work of the Teacher of Agriculture. (To be offered as a thesis for the M.S. degree; F. W. Lathrop, Adviser.)

The purpose of this study is to determine what problems the teacher of agriculture must meet on the job. The method is to request teachers of agriculture to make out a detailed diary for the period of one week. These diaries are to be analyzed and the jobs classified. The results of this study will be of considerable value in indicating what content should be included in the teacher training curriculum.

RALPH B. SMITH, B.S., Graduate Student.

The Organization and Method of Training in Service for Teachers of Agriculture. (To be offered as a thesis for the M.S. degree; A. V. Storm, Adviser.)

The purpose of the study is to determine the desirable types of organization for training in service and the technique of training in service used as far as it may be ascertained from the experience of men engaged in training in service. The questionnaire is being sent to most of the southern states and certain other states where an unusual type of training in service work has been done.

## ART EDUCATION

RUTH RAYMOND, B.S., Assistant Professor of Art Education and Chairman of the Department of Art Education.

Kinaesthesia in the Aesthetic Experience. (Thesis offered for the M.A. degree, University of California.)

Tests were applied, under controlled conditions, to groups of individuals varying in artistic ability and training. The material used, of three varieties—graphic, musical, and gymnastic—was of acknowledged emotional appeal, borrowed from the realm of art, and kept as abstract as possible. It consisted of: (1) a futurist painting in color; (2) significant, rhythmic lines from ten Japanese prints; (3) single lines of varying directions, forms, and rhythms, found at Columbia to have affective value; (4) four poses assumed in a dark and silent laboratory; (5) Rachmaninoff's Prelude in C sharp minor.



Laboratory results warranted the following conclusions: there is similarity of response on the part of various observers of the same work of art; both association and kinaesthesia are determinative of the type of response; the associational is based on the past experience of the individual observers and varies widely, but the kinetic response imitates the action implied in the case of the prints and of the single lines, the posture in the pose test, and, apparently, posture suggestions implied by rhythm and tendency tones in the music, and it shows striking similarities; there are indications that this kinetic factor is usually prior and roughly determinative of the associational.

Copies of the thesis are filed in the library and in the departments of Art and of Educational Psychology of the University of California.

## BUREAU OF EDUCATIONAL RESEARCH

MELVIN E. HAGGERTY, Ph.D., Dean of the College of Education and Professor of Educational Psychology.

1. (With F. von Borgersrode.) Unit Costs of Instruction in the College of Education for the Year 1924-25 and for the Summer Session of 1924.

This is a continuation of a study to determine the unit costs of instruction in all courses offered in education through a period of years. The "unit" is the "student-credit-hour" record as earned on the university registrar's books. The cost is figured on the presumed portion of an instructor's salary chargeable to a particular course and is based on the number of credit hours charged as the "instructor's load." The data are analyzed so as to show the cost per each student credit earned and the details are grouped by courses, by instructors, by departmental groupings, and for education as a whole. Similar data are available for the previous academic year, and for the summer sessions of 1923. The study will be completed by inclusion of similar analyses for the summer session of 1925 and the academic year 1925-26.

2. See also seven other studies listed under the Department of Educational Psychology.

FRED VON BORGERSRODE, B.S., Assistant Director, Bureau of Educational Research.

1. The Relation of Class Size and Efficiency of Instruction in University Courses. (To be offered as a thesis for the Ph.D. degree; Earl Hudelson, Adviser.)

The effect of variance in class size on results of instruction as measured by achievement of students. Data are drawn from records of past and present courses of the University of Minnesota. The treatment is experimental and statistical. The investigation is carried on in connection with the work of the sub-committee on class size, of the Committee on Educational Research of the University of Minnesota. Work in progress.

2. The Trend in the Relative Proportion of Funds Derived from Local Taxes Devoted to Municipal and Educational Expenditures in Minnesota Cities, 1922-24. (Typed copy available in the Bureau Library.)

Data taken from published reports of Minnesota State Tax Association, indicating the following conclusions: (1) There has been an increase in total tax levy since 1921, both in rates in mills and in the per capita levy, which although small is quite

significant. This is particularly true for the largest and the smallest cities. (2) There has been a decided increase in the tax levy for municipal purposes. (3) Tax levies for school purposes have actually decreased both in the rate in mills and in the per capita levy. (4) Although tax levies for school districts still make up the largest part of the total levy, they are gradually making up a smaller part of the entire tax load. The peak was in 1922. *School taxes can not be blamed for the increasing tax burden.* (5) Per capita taxable valuations in real and personal property have steadily declined in the smaller cities. This has aggravated the per capita figures given, and has made the tax rate in mills much higher than would otherwise be the case. While some of this lowering in assessed valuation may be real, the fact that it is confined to the smaller cities, leads to a suspicion that much of it may be due to a "soft hearted" and locally interested assessor.

### 3. The Trend in the Distribution of Current Educational Expenditures of Minnesota School Systems, Classified into Population Groups, 1921-24. (Copy on file in the Bureau Library.)

Material drawn from official reports to the State Department of Education. Treatment statistical.

### 4. Median Elementary and High School Enrollment and Number of Teachers in Various Types of Minnesota School Systems, 1924-25.

Data obtained from the educational director of Minnesota, 1924-25. Typed copies of the work are available in the Bureau files. The median number of teachers and of pupils is shown for the various types of schools, both elementary and high schools. The results are too extensive for a brief summary.

### 5. The Subjects of Study in Minnesota High-School-Department Schools. (Adviser, L. V. Koos.)

Material gained through replies to questionnaires, treated statistically. Work in progress.

### 6. (With others.) A Re-survey of Instruction in Austin, Minnesota, 1924. (Typed copy in the Bureau Library.)

This project was undertaken by the Bureau at the invitation of Superintendent S. T. Neveln and the Austin Board of Education, for the purpose of evaluating progress made in achievement in school subjects as determined by standard tests. Both intelligence and achievement tests were applied to the 1,300 children in all grades from one through thirteen. Test results were compared with similar findings in 1922. The data showed that in the main Austin made decided gains in achievement in nearly all subjects measured. Most noteworthy were the increases found in spelling and reading where the system as a whole was well above standard. Substantial increases were also made in arithmetic and composition. History and geography were still found to be pressing problems.

### 7. Composition and Objectives in Training of Student Body at the Summer Session College of Education, University of Minnesota, 1924. (M. E. Haggerty, Adviser.) (Copies available in the Library of the Bureau.)

Data for this project were taken from card records of summer students. Most of the students were from the field, less than 15 per cent being students during the regular year. Twenty-three states and Canada were represented. There seems to be a definite demand for specialized professional training, twenty-six separate fields being indicated. This shows a distinct need for expansion of curricula.

WILLARD C. OLSON, M.A., Instructor in Educational Research, Bureau of Educational Research.

1. The Incidence of Behavior Problems in School Children with a Method for Diagnosis and Suggestions for Amelioration. (Thesis to be offered for the Ph.D. degree; M. E. Haggerty, Adviser.)

Eight hundred children in the Longfellow School of Minneapolis were studied by means of a behavior record sheet and a graphic rating scale. The score shows significant relationships with certain factors in the school situation such as intelligence and age-grade status. The graphic rating scale consisted of thirty-seven character traits on which the teacher rated each child by the "cross on a line" method. The relationship of each character trait to overt misbehavior was then studied. Further study is planned to show the extent to which factors in the school situation may be modified to reduce the number and seriousness of conduct disorders. Clinical study was given a group of selected cases and remedial measures proposed. The subsequent history of these cases is being studied to determine the efficacy of the clinical treatment. The tentative behavior record and character rating scale is being revised on the basis of data on validity and reliability obtained from the present study. A survey of certain elementary school grades will be undertaken with the new form to supply normative data.

2. The Constancy and Reliability of an Intelligence Quotient Determined by the Haggerty Intelligence Examination Delta 2. (Under the direction of M. E. Haggerty.)

The pupils in the elementary grades of the Austin public schools were tested for three successive years with the same examination. Correlations between tests and retests with the probable error of the predictions from the regression equations indicate a high degree of reliability and constancy for the intelligence quotient. Repeating the same form of the test results in a larger practice effect than appears in the use of the individual examinations.

## EDUCATIONAL ADMINISTRATION

FRED ENGELHARDT, Ph.D., Professor of Educational Administration.

1. A School Building Program for Robbinsdale, Minnesota, 1925. *University of Minnesota Educational Monograph* Number 8.

A building and financial survey of the school district. The appendix includes an outline of a technique developed for the forecasting of school population in a rapidly growing school district.

2. The Aitken Survey. (Unpublished. Bound copies in the University Library.)

A survey of the educational facilities of Aitkin, Minnesota. The survey includes a detailed study of the school plant facilities, the school population and the instruction. In the survey of instruction, a detailed diagnostic analysis is made and specific remedial measures are set forth in detail.

3. The Forecasting of School Population. *Columbia University Teachers College Publication*, Number 177. New York City. 110 pages.

An analysis of the various methods used in the forecasting of population and their adaptability for use in prognosticating school population trends and growth. Special emphasis is placed in showing the possibilities of a mathematical analysis of school population growth.

#### 4. Forecasting School Population. *School Board Journal*, 80:47-53.

This article sets forth the possible adaptation of the Bell telephone forecasting technique in forecasting school population. The article also illustrates the results of applying a mathematical technique in forecasting school population in certain selected cities.

5. See also the studies by I. O. Friswold, J. E. Grinnell, M. L. Gundlach, P. A. Jarvis, and E. B. Sackett.

LEONARD V. KOOS, Ph.D., Professor of Secondary Education.

#### 1. Analysis of the Literature Dealing with Extra-curricular Activities in Secondary Schools.

The study was made for a committee (L. V. Koos, chairman) preparing a year-book on extra-curricular activities to be published in 1926 by the National Society for the Study of Education. The report of the analysis will appear as the first section of the volume. The results of the analysis fall into the following divisions: (1) the values claimed for allied activities; (2) obstacles to achieving the values; (3) the principles to be followed in administering and supervising the activities; and (4) the types of activities proposed or reported to be in operation.

#### 2. A Comparison of the Teachers' Use of Class Periods in High Schools Operating on the Supervised and Non-supervised Study Plans.

The chief aim of the study is apparent from the title. The method is visitation of classes in high schools in Minneapolis reported to be operating on one or the other of the two plans and noting what procedures are followed, the order in which they come, how much time is given to each, and what methods are used to achieve the values claimed for supervised study. Members of classes in the supervision of high school instruction made the visits, each member observing classwork in the same subject and course in schools reported to be following the two plans. The major findings so far are (1) the wide variation in practice from teacher to teacher and subject to subject; (2) the more extended use of supervised study in the longer period; (3) the much greater variation in the order of procedures (assignment, recitation, supervised study, etc.) in the long-period schools; and (4) the appearance even in the short-period schools of some of the features of supervised study.

#### 3. The High School Principal. Boston: Houghton Mifflin Company. 1924. 121 pages.

This monograph reports a study of the high school principalship. The data used were supplied by more than four hundred principals distributed at random over the entire country and pertain to (1) the training of present incumbents as measured by highest degrees held, extent in years of training after high school graduation, preparation in academic and other lines, and amount and nature of professional work taken; (2) occupational plans as undergraduates of the high school principals; (3) their experience; (4) their time for administrative and supervisory activities; and (5) their responsibilities other than teaching. The major conclusion is that, although the principalship is still far from complete professionalization when thus measured, the position is on the way to professional status. Recommendations toward accelerating professionalization are (1) to extend the period of preparation and map out for those in training for the work special professional curricula; (2) to guide and recruit capable young men for the work; (3) to stimulate and participate in research along professional lines; and (4) to seek initiative and professional responsibilities in principalships vested with too little initiative and responsibility.



4. High School Teachers' Meetings: A Study of Preferences. *American School Board Journal*, 69:35-36. 1924.

The study here reported was aimed at ascertaining high school teachers' attitudes and preferences concerning teachers' meetings. The materials were unsigned responses to a blank of inquiry and ballot by approximately four hundred teachers in twenty-five high schools. The conclusions pertain to such matters as preferred topics for meetings, and arrangements as to time, duration, participation, attendance, etc. For the most part, teachers are favorable to such meetings, if they are made professionally constructive.

5. Investigations Concerning Literature Studied in Conjunction with Courses in English in Grades VII-XII.

The purpose of these studies is to afford criteria for the selection and teaching of literature in secondary school grades. Only two of a number of studies have been so far undertaken. One of these is a tabulation of the frequency of use of all selections reported to be studied in the grades referred to in almost two hundred school systems selected at random and representatives of the several sections of the country. Several other investigations to be made wait upon the completion of these tabulations, work on which is about half done. The other is a study of the aims and values claimed for the study of literature in secondary schools as shown in a wide variety of literature on the subject. This study is preliminary to one which will aim at securing weighted objectives in the teaching of literature to be used as a partial basis in evaluating the selections found in the first study described. Work in progress.

6. The Junior College Movement. Boston: Ginn and Company. 1925. 436 pages.

The volume represents an evaluation of the junior college and is a rewriting and abridgment of *The Junior College*, *Research Publications of the University of Minnesota, Education Series*, No. 5, which was published in May, 1924. The chapter headings are: I, The Scope and Variety of the Movement; II, Current Conceptions of the Special Purposes of the Junior College; III, The Junior College in Its Isthmian Function—The Offering; IV, The Junior College in Its Isthmian Function—Instructors and Instruction; V, The Junior College in Its Democratizing Function; VI, The Junior College in Its Conserving and Socializing Influences; VII, The Trend of Reorganization in Higher Education; VIII, Overlapping in High School and College; IX, Evaluating the Types of Junior Colleges; X, The Problems of Location and Maintenance. The volume contains also a selected bibliography.

7. The Student-Body of a Night High School.

The study aimed at a description of the students in one night high school in the following respects: sex, age, country of birth, country of birth and occupations of fathers, extent of self-support of students, previous attendance in other secondary schools, purposes in attending night high school. Among the findings are the following: three fourths of the students are beyond the typical high school age; while fathers of the students are predominately foreign born, almost three fourths of the students were born in this country; the occupational distribution of fathers favors the lower economic levels more than does the distribution for regular high schools; the median student gives more than eight hours daily to employment; more than a third report that they are taking the courses for purposes of college preparation.

8. Teacher Training. Chapter VII (pages 285-325) in *Survey of Higher Education in Cleveland*, by George F. Zook and others. Cleveland, Ohio: Cleveland Foundation Committee. 1924.

The purpose of the study was to inquire into the relationships of the training of teachers in the Cleveland public schools and the facilities for teacher training in local higher institutions. The materials were data concerning the extent

and nature of the preparation of recent recruits to the teaching staff of elementary schools, junior high schools, and senior high schools of the city, and concerning the facilities for teacher training in the Cleveland School of Education and Western Reserve University and the places of service of the product of these higher institutions. For purposes of comparison materials were gathered concerning the offerings in education in thirteen of the stronger schools of education in universities of the United States. The chief conclusion was the need of vigorous expansion of the facilities in the greater university proposed for Cleveland.

9. See also the studies by J. O. Powers, O. L. Troxel, E. J. Dahl, C. E. Blume, R. C. Breiseth, E. M. Dougherty, A. Gaardsmoe, R. M. Malone, H. W. Small, L. L. Stowell, E. W. Tiegs, E. C. Van Dusen, L. D. White, J. M. Hughes, and P. W. Hutson.

FLETCHER H. SWIFT, Ph.D., Professor of History of Education.

1. Studies in Public School Finance, Volume 3, The Middle West: Illinois, Minnesota, South Dakota; together with a supplement on Public School Finance in Alaska. *Research Publications of the University of Minnesota Education Series* Number 3. xii, 329 pages.

Abstracted in part under O. L. Troxel, who assisted in the study for South Dakota.

2. Studies in Public School Finance. Volume 4, The South: Arkansas, Oklahoma, Alabama and Tennessee. *Research Publications of the University of Minnesota Education Series* Number 4. xvi, 224 pages.

3. See also the studies by J. O. Powers and O. L. Troxel.

LEO J. BRUECKNER, Ph.D., Associate Professor of Education.

1. A Survey of the Use Made of the Supervised Study Period. *School Review*, 33:333-45. May, 1925.

This article reported an investigation of the use made of the supervised study period in West High School in Minneapolis. It was based on reports by teachers of the amount of time given to the recitation, to the assignment, and to the supervised study period. Teachers also reported which activity occurred first during the class period, which second, and which third. The results were tabulated according to subject, irrespective of grade. Since there had been no prescribed procedure adopted by West High School, which was experimenting with supervised study, the results revealed the conditions that might exist if instruction were carried on in accordance with conditions as they arose in the classroom rather than according to an arbitrarily established division of time. The results of the investigation show that there was a very great variation in the amount of time given to supervised study in the different subjects and from class to class. The median for the amount of time for supervised study was about twenty minutes per day. There was no uniformity of order in which the assignment, recitation, or supervised study period occurred. The chief problem raised by this investigation is the validity of the procedure followed in some schools which prescribe a definite amount of time for supervised study, regardless of the subject and also a definite time allotment to be set aside for each part of the recitation.

2. The Revision of the Social Science Curriculum of Minneapolis.

A survey has been made of present day courses in social studies. They have been analyzed and a special bulletin has been published making available for all teachers in Minneapolis results of the investigation. A special study of the problem project procedure in teaching history, geography and other social studies as an

important part of the work is under way. The program is being carried on through committees of teachers and principals. Teachers are submitting reports of projects which they have tried out. These are being summarized and are to be published in the fall as a special bulletin on the problem of curriculum revision in the social studies.

### 3. The Use of Free Activity Periods in Determining Errors in Oral Speech. *Journal of Educational Method*, 10:248-53. February, 1925.

A study was made in the Minneapolis schools which resulted in a city wide list of the most common errors found in oral English. This list was used as a basis for an intensive campaign to eliminate errors in oral English. It was found in Minneapolis that very few errors occurred during the lessons in which the teacher was in charge. This was due in part to the fact that the recitations of pupils were limited to short sentences or three or four words. A much more complete list of errors was found by observing the errors made by children during free activity periods, such as civic meetings in the classroom, socialized discussions about problems raised by the pupils themselves, and other activities that might take place when the teacher was not in charge. This study was carried out in all of the schools in Minneapolis in grades 3 to 6, for one week. Results for thirty-three schools for grades 3, 5, and 6 revealed over twenty thousand different mistakes which were made by the pupils. This list has since been incorporated in the Minneapolis course of study.

### 4. Diagnostic and Remedial Work in Arithmetic.

Results revealed by tests show that many pupils in the Minneapolis schools are deficient in arithmetic, both in the fundamentals and in reasoning problems. Diagnostic tests in the fundamentals have been prepared and their use demonstrated to the teachers of the city. A special bulletin on remedial work in arithmetic was published as *Educational Bulletin* No. 5 of the Minneapolis series. It contains descriptions of procedures to be used in diagnosing pupil difficulties and types of remedial work that can be used to overcome specific weaknesses. Results of tests that have been given show that there has been an increase in reasoning ability of over two years as a result of the concentrated effort to bring about improvement. These results are published in *Minneapolis Teachers Bulletin* No. 51 for March 19, 1925.

### 5. Individualized Arithmetic Drill Exercises for the Second Grade.

Supervisory inspection revealed the fact that there was much time wasted in the primary grades in arithmetic, due to the fact that teachers did not have adequate materials for carrying on satisfactory drill. The drill material that was used was not properly organized. A survey was made by a committee of principals to discover the best types of drill material in use in the city schools. Some valuable material was collected and analyzed. A set of thirty drill exercises in addition and subtraction for use in the second grade has been constructed and printed. It is now in use in ten schools, experimentally. The drill cards provide for individualized drill adapted to the needs of the pupils and are self-scoring and self-teaching. They have been in use during the last three months of the present semester and have worked very satisfactorily. It is planned to extend their use to other buildings in the city in September.

### 6. The Value of a Time Analysis of Classroom Activity As a Supervisory Technique. *Elementary School Journal*, March, 1925. Pages 518-21.

This report contained the results of an investigation made to determine the distribution of the time spent by teachers on different activities in primary reading. A list of the activities that usually occur during the primary reading lesson was prepared and teachers were asked to indicate on a blank the amount of time given each day for a week on each of the activities. In this way the teacher made an objective

study of the work in her class from one point of view. After the teacher had completed her report a conference was held with the principal at which the results were discussed. The data for the teachers in seven schools were assembled and medians found. There was clear evidence that silent reading was being stressed in the grades and that some phases of the reading were not given adequate attention. The summary of the results for these schools was made available for all teachers in Minneapolis in a special bulletin on reading. A direct outgrowth of the investigation was the wider use of flash card material to secure increased speed of rate and a better span of comprehension.

### 7. Minneapolis Composition Scale.

With the aid of a committee of principals, a set of compositions was prepared to serve as standards for composition work in the Minneapolis schools for the first six grades. These samples were secured by sampling compositions sent in from the various elementary schools. Previous experimentation had revealed the value of giving pupils objective standards which they might use in grading their own work. These scales have been printed and are in use in all of the schools in Minneapolis. They are being used as definite checks on oral composition work. The fact that the reasons are stated why a sample is given the rank it is given, has been found to stimulate in most desirable ways the work in oral composition. A similar scale for friendly letters was also published. The principals who co-operated in this study were Ella Probst, Calhoun School; Helen Shove, Longfellow School; Maria Porcher, Bancroft School; and Katherine Young, Marcy School.

8. See also the studies by H. J. Steel, H. W. Distad; also those by H. E. Marshall, and R. M. Peet (Department of Theory and Practice of Teaching).

WESLEY E. PEIK, M.A., Professorial Lecturer in Education.

An Analysis and Evaluation of the Prescribed Educational Courses Offered by the College of Education of the University of Minnesota for the University Certificate To Teach a Secondary School Subject. (To be offered as a thesis for the Ph.D. degree; M. E. Haggerty, Adviser.)

The purpose of the investigation is indicated by the title. The work involves: (1) Analysis of the syllabi of educational courses now offered into 816 separate topics; (2) A study of the degree of overlapping of courses; (3) Evaluation of the practical and theoretic worth of the topics by seniors and by alumni by means of a questionnaire and a checking list.

GEORGE A. SELKE, B.S., Professorial Lecturer in Education.

An Occupational Analysis of the Work of the Superintendent of Schools in Minnesota Cities. (Thesis to be offered for the Ph.D. degree; M. E. Haggerty, Adviser.)

The purpose of the study is to find out what are the duties, responsibilities, and activities of the superintendent of schools in Minnesota so that proper administrative courses may be offered in colleges of education. The material used is the records in the State Department of Education, detailed diaries kept by superintendents, and questionnaires dealing with the work of the superintendent. Preparation of report is in progress.

J. ORIN POWERS, Ph.D., Instructor in Educational Administration.

1. A Comparative Study of Instructional Outcomes in Academic Subjects in Non-Junior and Junior High Schools of Minneapolis. (Thesis for the Ph.D. degree; L. V. Koos, Adviser.)

The study was based on (1) the results of intelligence and achievement tests; (2) records and reports of the Departments of Attendance and Research of the Min-



neapolis Public Schools, and (3) a pupils' questionnaire. The results are too extensive to be abstracted briefly, but the following general conclusions are reached:

1. Junior high school reorganization in its external features without specific reorganization in content of courses and methods will not materially change the outcomes of instruction in the academic subjects.

2. Superior advantages in retention of pupils, more rapid promotion, enrichment of curricula, etc., are possible without loss in individual scholarship.

3. The amounts of class time devoted to teaching academic subjects may be reduced without material losses.

4. Better retention of pupils may be secured through junior high school reorganization by means of adaptations to the types of pupils leaving.

5. More significant results may be attained in vocational guidance through specific provisions for guidance.

2. The Ethics of the Teaching Profession. (L. V. Koos, Adviser.) To be published in *Journal of Educational Research*.

A summary of the provisions of codes of ethics adopted by associations of teachers and of articles written by educators relating to ethics for teachers.

3. Legal Provisions and Regulations of State Departments of Education Affecting Junior High Schools. (L. V. Koos and F. H. Swift, Advisers.) *School Review*, 33:280-91. 1925.

A summary of the laws existing in states of the United States relating to the organization and administration of junior high schools; a summary of regulations and recommendations of the state departments and recognizing or approving agencies; and conclusions.

EDWIN J. DAHL, B.S., Assistant in the University High School.

An Analysis of Senior High School Textbooks in Civics, Economics, Sociology, and Problems of Democracy. (To be offered as a thesis for the M.A. degree; L. V. Koos, Adviser.)

The materials used includes fifteen texts in civics, twelve in economics, seven in sociology, and six in problems of democracy. In addition to this, the writer has used the questionnaire method, by which he is attempting to discover some of the current practices in the teaching of these social studies. This blank, in addition, asks those who answer to indicate values to high school students of each of some twenty-five topics usually considered in these social science studies. This part of the study will attempt to show which of these topics are considered to be of greatest value to high school students.

HJALMER W. DISTAD, M.A., Graduate Student. Assistant in the Department of Tests and Measurements, Minneapolis Public Schools.

1. Construction of a Series of Practice Exercises in Common Fractions. (Under the direction of L. J. Brueckner.)

The purpose was to construct a series of exercises in common fractions which could be used like the Courtis practice exercises and which would give pupils the drill necessary to develop each specific ability. Only those denominators are used which have been found to occur most frequently in real life. The exercises are now being tried out in a number of Minneapolis schools.

2. A Study of the Retention of Pupils on Several Types of Reading Material Read under Different Conditions. (To be offered as a thesis for the Ph.D. degree; L. J. Brueckner, Adviser.)

The four types of reading material being used in the study are geography, nature, narration, and poetry. These are given to pupils in grades 5B to 8A, inclusive. The

conditions under which the pupils read the materials are reading with no direction, reading to find the answers to specific questions, reading to find the answers to a general problem, and reading to find the answers to questions raised by the pupils themselves. The method of comparison being used is to create equivalent groups by matching scores on standardized reading tests. The performances of several groups reading under different conditions are then compared on each type of material.

INGOLF O. FRISWOLD, M.A., Assistant in Educational Administration.

Public School Indebtedness with Special Reference to Minnesota. (Thesis for the M.A. degree; Fred Engelhardt, Adviser.)

An intensive study of the problem from the point of view of sound financial practice, trends, extent, cost, and the legal aspects of public school indebtedness in Minnesota from 1849 to 1925. The study is based chiefly on source material found in the financial reports of school districts and other state documents. The study shows that in 1924, over 50 per cent of the value of all school houses and sites was outstanding in the form of debt. Likewise, some 50 per cent of the present school debt exceeding \$70,000,000 has accumulated in the last eight years. The evidence indicates that public school indebtedness in Minnesota has reached a magnitude which warrants a careful consideration on the part of school officials to insure its proper management.

PERCIVAL W. HUTSON, M.A., Formerly Assistant in Educational Administration. Assistant Professor of Secondary Education, University of Pittsburgh.

The Special Preparation of High School Teachers for Their Teaching Subjects. (Thesis to be offered for the Ph.D. degree; L. V. Koos, Adviser.)

The purpose is to discover by samplings in California and Pennsylvania the extent to which facts of teacher preparation already revealed in Washington and Minnesota are duplicated and may be said to be indicative of a universal condition over the United States; to analyze more closely than heretofore the special preparation of teachers of English and social studies; to determine the practices of certification authorities and the extent to which they are responsible for present conditions of teacher preparation; to gather evidence of college and university policies in guiding students in their selection of subject-matter courses; to secure data showing the extent to which the making of the high school daily schedule presents difficulties that hinder proper utilization of the teacher's special preparation; to make constructive suggestions on the basis of the facts revealed to all who are concerned in preparing the teacher and utilizing her preparation.

HARRY J. STEEL, B.A., Assistant in Educational Administration and Supervision.

Methods of Arithmetic Drill Used by the Best Teachers. (Thesis to be offered for the M.A. degree; L. J. Brueckner, Adviser.)

The identity of these best teachers has been determined by the amount of gain or growth made by classes under their instruction during three school semesters as measured by the Courtis supervisory test in arithmetic. In selecting these teachers, the size of class, attendance, intelligence of the pupils, and the transitory character of the population in some rooms, has been considered. Reports on drill methods, devices, and procedures have been secured from the better group of teachers by questionnaire and an activity analysis blank. The study is confined to the Minneapolis schools. Work in progress.

OLIVER L. TROXEL, M.A., Assistant in Educational Administration.

1. A Study of State Control of Secondary Education. (Thesis to be offered for the Ph.D. degree; L. V. Koos, Adviser.)

The purpose or problem is to locate and analyze the methods used by the various states in controlling the secondary schools within the state. Materials: state school laws, and documents of state departments of education, particularly state standards for high schools. Method: location and analysis of those elements in the materials pertaining to the states' exercise of control over secondary education. No conclusions can yet be drawn.

2. See also the study listed under the Department of Theory and Practice of Teaching.

3. Public School Finance in South Dakota. (Thesis for the M.A. degree; F. H. Swift, Adviser.) Included in the *Research Publications of the University of Minnesota, Education Series* Number 3.

The following conclusions are reached:

1. South Dakota depends very largely on the school district as the unit of school support.

2. As compared with other states, the permanent school fund of South Dakota is large, but the income from the fund is of decreasing importance as the total amount of money spent on the schools increases.

3. Inequalities in educational opportunities within the state are enormous as shown by differences in length of school year; training and salaries of teachers; percentage of enrolment and attendance; and amount per capita spent on schools.

4. Inequalities in burden of support within the state are enormous as shown by differences in the rate of taxation and amount of state aid received by districts.

5. The present method of school support is not adequate to give all children anything like equality of educational opportunity and to equalize the burden of support among the taxing units of the state.

CLARENCE E. BLUME, B.A., Graduate Student.

A Comparison of Time Expenditures of Students in High Schools with the Forty-five and Sixty Minute Periods. (Thesis for the M.A. degree; L. V. Koos, Adviser.)

The chief purpose is the comparison of student time expenditures both in and out of school in schools operating on a supervised study program with those operating with the usual length of period. The two high schools represented are Central and West in Minneapolis. The sources of data are the unsigned reports by students on each course, for each day of the week, etc. Tabulations are still in progress.

RUTH C. BREISETH, M.A., Graduate Student.

A Study of the Content and Management of High School Newspapers. (Thesis for the M.A. degree; L. V. Koos, Adviser.)

Brief questionnaires and requests for papers were sent to five hundred schools selected at random from fourteen states in the central and south central sections of the country. One hundred twenty-five papers were analyzed, with the following results:

1. Weekly papers were found to be most numerous in schools which had enrolments of 1,000 or more; bi-weeklies, in schools which enrolled from 400 to 1,000 pupils; and weeklies were popular among the smaller schools.

2. The modal paper was a four-page, five-column paper.

3. Advertisements occupied almost 25 per cent of all space in the 125 school papers and information about athletics consumed approximately 12 per cent of the space. Other types of content took up less space.

4. It was noted that an increase or decrease in enrolment influenced the character of a school's paper. Increased enrolment meant an increase in the percentage of space used for the following types of materials: athletics, editorials, personals—society, clubs—organizations, departments—feature sections, faculty news, cartoons—pictures, alumni notes. On the other hand there were topics for which the space decreased when enrolment increased: advertisements, locals—miscellaneous, humor, literary attempts, class notes, talks—programs, flags—staff lists. Other significant conclusions are not here summarized.

ELEANOR M. DOUGHERTY, B.S., Graduate Student.

A Study in the Personnel of Normal-Training Classes in Twenty-five High Schools. (To be offered as a thesis for the M.A. degree; L. V. Koos, Adviser.)

The purpose of the study is to provide a description in a number of respects, scholastic and other, of the members of the normal training classes in Minnesota high schools. The materials of the study are the results of intelligence tests and of achievement tests in certain common branches, and data concerning occupations of parents, religious preferences, etc. The study involves a comparison of these students with all seniors in the same high schools, one purpose being to ascertain what types of selection are operative in making up the normal training classes. Work in progress.

ALMA GAARDSMOE, B.A., Graduate Student.

1. Analysis of Textbooks in Mathematics Used in Seventh, Eighth, and Ninth Grades in Reorganized and Unreorganized Schools. (To be offered as a thesis for the M.A. degree; L. V. Koos, Adviser.)

The purpose of the investigation is to compare, as far as can be done by means of analysis of textbooks reported to be in use, the content of courses in mathematics in junior and non-junior organizations of the grades concerned. It should answer, among others, such a question as, What changes in content and organization of mathematics in these grades accompanies junior high school reorganization? The frequency of use of texts, as well as additions and omissions from them during progress of the courses, were ascertained by special inquiry. The method of analysis is by page-to-page measurement, after having arrived at a comprehensive list of types of content by means of a preliminary survey of a number of texts. As text analysis is not yet completed at this writing, it is too early to draw conclusions on detailed content, but the distribution of texts shows a wide variety of practice.

2. See also the study listed under the Department of Theory and Practice of Teaching.

JOHN E. GRINNELL, M.A., Graduate Student.

Newspaper Publicity for the Public Schools of the State of Minnesota. (Thesis for the M.A. degree; F. Engelhardt, Adviser.)

A critical review of the publicity given public schools in the daily and weekly press of Minnesota. The study is based on an intensive study of the data appearing in the newspapers during the fall and winter of 1924-25, and a questionnaire study of the attitude of newspaper men toward the schools and the use of the newspaper as an agency of public school publicity. The study shows a basic need of a co-ordinated plan of publicity as a part of the educational program fostered by the local school superintendent. A suggested plan of procedure is outlined.



MELVIN L. GUNDLACH, B.A., Graduate Student.

A Critical Analysis of the Organization, Administration, and Supervision of Public Libraries and School Libraries in the Various States. (Thesis to be offered for the M.A. degree; F. Engelhardt, Adviser.)

A study of the laws and state regulations governing the organization, administration, and supervision of the libraries in the various states. The study shows the trends and tendencies in the development of this important educational institution. It points out the desirability of greater co-ordination of the various functions in the interests which libraries are intended to serve.

JAMES M. HUGHES, Ph.D., Graduate Student. Assistant Professor of Education, Northwestern University.

1. The Use of Tests in the Evaluation of Factors Which Condition the Achievement of Pupils in High School Physics. *Journal of Educational Psychology*, 16:217-31. 1925.

2. A Study of Intelligence and of the Training of Teachers As Factors Conditioning the Achievement of Pupils. *School Review*, 33:191-200; 292-302. 1925.

3. The Hughes Physics Scales Information R and S, Thought R and S, Divisions 1 and 2. (Including a Manual of Directions.) Bloomington, Illinois: Public School Publishing Co. 1925.

These publications represent extracts from, and outgrowths of, a thesis (for the Ph.D. degree; L. V. Koos, Adviser) inquiring into the factors of efficiency of students in high school physics. In order to make measurement possible, the investigation included the construction of tests and scales. Mental test scores and other data concerning the students were also used, as well as information concerning methods of teaching, training of instructors, etc. The factors appearing to be more influential than others were intelligence as shown by mental test scores and the extent of collegiate training in physics of the teachers. The latter factor may, however, be the intelligence of the instructor resulting from the selection of the larger amounts of collegiate physics represented.

PAUL A. JARVIS, B.A., LL.B., Graduate Student.

The Legal Rights and Liabilities of Boards of Education in Their Official Relationships to Teachers, Pupils, and Other Individuals. (Thesis to be offered for the MA. degree; F. Engelhardt, Adviser.)

A collection and classification of all cases relating to the rights and liabilities of school boards in their relationship to teachers, pupils, janitors, and other individuals. The study represents the collection of all such cases from state supreme court decisions, state statutes, ruling of state boards of education, and the leading law reviews. The purpose of this study is to present this material in usable form as a guide to superintendents and school boards in the formulation of rules and regulations relating to the school personnel.

ROSE M. MALONE, M.A., Graduate Student.

Materials Common to the Social Sciences in the Elementary and Secondary Schools. (Thesis for the M.A. degree; under the direction of A. C. Krey and L. V. Koos.)

This study is based upon an analysis of the materials presented in the various readers in English and textbooks in the social studies in use in the twelve grades of the Minneapolis schools. It is a pioneer work, the chief value of which lies in the disclosure of many problems to be solved. It contains numerous tables revealing all the steps made in the process of this study and these will be particularly useful to later workers. Among the immediate contributions of this work is the revelation of the amount of repetition of the same items of information throughout the twelve years.

EVERETT B. SACKETT, B.A., Graduate Student.

An Analysis of the Organization, Administration, and Supervision of Health Education and Physical Education in the Various States. (To be offered as a thesis for the M.A. degree; F. Engelhardt, Adviser.)

An investigation of the departments, bureaus, and other state and local agencies intrusted by law with the responsibilities for the administration, organization, and supervision of the various health factors in so far as they concern the public school. The study points out the trends and the gradual tendency to place all matters pertaining to the health of school children under the jurisdiction of the proper public school authorities.

HARRY W. SMALL, B.A., Graduate Student.

A Study of the Social Composition of the Student Body in Smaller High Schools of Minnesota. (Thesis to be offered for the M.A. degree; L. V. Koos, Adviser.)

The purpose of the study is to throw light on the occupational distribution of parents, and therefore, to some extent the economic levels from which high school students are drawn in rural territory and smaller cities. Professor Counts' study (*The Selective Character of American Secondary Education*, University of Chicago Press) included only large urban high schools. The purpose of the present study is to study the social composition of student bodies in communities ranging from very small to very large. The method is similar to that used by Counts, except that classifications of occupations have been to some extent adapted to smaller communities.

LLOYD L. STOWELL, B.S., Graduate Student.

A Study of Space Provisions in Junior High School Buildings. (Thesis to be offered for the M.A. degree; L. V. Koos, Adviser.)

The purposes of the study are ascertaining the kinds of space provisions made in junior high school buildings, their location in the plans, the uses being made of them, and to some extent discovering criteria to be followed in planning future buildings. The materials are large-scale blue-prints of buildings now in use and responses to inquiries concerning utilization. The study has not yet been completed.

ERNEST W. TIEGS, M.A., Graduate Student. Assistant to the Superintendent of Schools, Minneapolis.

A Comparison of the Efficiency in the Common Branches of Students in the Ninth and Twelfth Grades of the Minneapolis Schools. (L. V. Koos, Adviser.)

The purpose of the investigation is to inquire into the extent of increase or decrease in abilities in composition, reading, spelling, handwriting, and arithmetic, between these grades under present conditions of school work. The chief feature of method is the giving of standard tests of achievement in these subjects to students in the two grades named. Work in progress.

EARL C. VAN DUSEN, M.A., Graduate Student.

A Comparison of Two-Year and Three-Year Junior High Schools in Kansas. (Thesis for the M.A. degree; L. V. Koos, Adviser.)

The purpose was to compare these two types of reorganization primarily with respect to the programs of study and content of subjects offered in the curriculum; but also, as to housing, time schedules, and certain other administrative relationships. The methods were largely those of tabular comparisons of subjects offered and of the content of courses by means of a detailed analysis of the textbooks in use in the schools. The major conclusion is that the two-year type results in much less of reorganization than does the three-year type.

LESTER D. WHITE, B.A., Graduate Student.

A Study of Relationships between High School Careers of Graduates of Small High Schools and Their Major Subsequent Activities, Occupational and Other. (To be offered as a thesis for the M.A. degree; L. V. Koos, Adviser.)

The "careers" will include courses pursued, success as measured by marks given, and similar data. The materials for the study were gathered by visits to the schools and communities represented.

## EDUCATIONAL PSYCHOLOGY

MELVIN E. HAGGERTY, M.A., Ph.D., Dean of the College of Education and Professor of Educational Psychology.

1. Training the Superintendent of Schools. *University of Minnesota Educational Research Bulletin*. Volume 28, Number 17. April, 1925. 29 pages.

A brief analysis of the work of the superintendent of schools with an evaluation in terms of the criteria requisite to professional status for the position. The paper deals with the requirements for certification, the tendency of superintendents to seek advanced professional training, the economic status of the superintendency, the function of the superintendent as a financial expert, a director of health activities, a supervisor of instruction, a trainer of teachers, a public advocate of education, etc. On the basis of the analysis there are stated certain principles of professional training applicable to the superintendency. The discussion stresses the need for practical training, the provision for an "administrative internship," and considers the place of research and thesis writing in the training of the schoolman.

2. The Incidence of Behavior Problems in Public School Children. *Journal of Educational Research*. September, 1925. (In press.)

A study of the existence and distribution of behavior difficulties as noted by teachers in the pupils under their charge. An itemized schedule of undesirable behavior was furnished to all the teachers of a large elementary school for making a record of all behavior problems in their several rooms. Reports were made on eight hundred children 51 per cent of whom showed undesirable behavior of mild or serious type. A "behavior score" was computed for each child and these behavior scores were correlated with age, sex, grade, progress in school, and intelligence. Case studies were made of pupils with high behavior scores. The significance of the study lies in (1) the initial development of a technique for measuring undesirable behavior; (2) the revelation of the incidence of such behavior; and (3) the discovery of the educational concomitants of such behavior.

3. Reading and Literature. Vol. I, 512 pages. Vol. II, 576 pages. Yonkers, N. Y.: World Book Co. (In press.)

Collection of prose and poetical selections suitable for use in the junior high school, based upon recent scientific studies of the specific interests of adolescent children and upon the special functions of the junior high school. Contains much new material not hitherto available in school readers, edited with explanatory notes and glossary. New methods for improvement in vocabulary, rate of reading, and comprehension. Makes use of measuring devices in the field of vocabulary, rate and comprehension in silent reading, the analysis and evaluation of character traits by pupils, and in the appreciation of the informational and literary qualities of prose and poetry.

#### 4. The Evaluation of Literary Selections. (Unpublished.)

This study concerns the development of a rating sheet by which to evaluate the usefulness of a literary selection for the purposes of junior high school instruction. The sheet involves the analysis of the four following factors affecting the availability of a selection for this purpose: interest, information, appreciation and taste, and moral and ethical values. The analysis of points was based on a total of 1,000 divided as follows: Interest, ten items, maximum score 400; Information, ten items, maximum score 200; Taste, five items, maximum score 200; Moral and ethical values, ten items, maximum score 200. These values were determined by a study of the judgments of about 300 teachers. Ratings were made by 50 qualified and experienced persons (mostly teachers) on 245 different selections commonly found in school readers. The results were treated statistically to determine the selections upon which the consensus of judgment was sufficiently great to be significant. The largest scores were given to selections of adventure or to those having a distinct moral emphasis. The variation in judgment proved very great, the median deviation of the score being in some cases as high as the score itself. In other cases there was a grouping of judgments with a sufficiently low variation to make the central tendency significant.

#### 5. The Vocabulary of Junior High School Reading. (Unpublished.)

An analysis of the vocabularies of five hundred prose and poetical selections suitable for junior high school reading. The material studied extends considerably beyond the selections included in Books I and II of *Reading and Literature*, and is supplemented by an analysis of the history texts used in schools. The words have been tabulated and simply defined and are to be used for the development of techniques designed to improve vocabulary instruction in junior high school grades. The words are to be used also for making of a wide range of tests designed to measure vocabulary achievement and to study the capacities of pupils to achieve a mastery of English words. A limited portion of the words will appear as glossaries in the two volumes of *Reading and Literature*.

6. (With H. B. Nash.) Mental Capacity of Children and Paternal Occupation. *Journal of Educational Psychology*, 15:559-72. 1924.

A study of the intelligence level of 6,688 pupils in New York "rural" schools, i.e., schools in districts of 4,500 population or less. Tests were made by the Haggerty Intelligence Examination Delta 2 in grades 3 to 12 and the results were grouped in terms of occupations of the fathers of the pupils tested. The results showed a median I.Q. of 95.5 for the entire grade group and 110.5 for the high school group. The highest and lowest I.Q.'s for occupational groups were 116 (grade) and 121 (high school) for the children of professional fathers, and 89 (grade) and 108 (high school) for the sons and daughters of unskilled laborers. Bright and dull children occur in all groups although the percentages are not constant. The professional fathers have the fewest dull children and the unskilled fathers have the fewest bright children. The differences are great enough to be significant for educational theory and practice.



### 7. Studies in Curriculum-Making.

Under this heading is here grouped a series of investigations undertaken for the purpose of improving the curricula provided in the College of Education for training students for public school teaching and administration. In general the method is that of occupational analysis, by means of which it is sought to identify objectively the functions actually performed by the several types of school workers. Studies are made of the activities of expert teachers, of pupils in the schools, and of the persons in the community. In this way there are assembled the items of knowledge and skill necessary to a successful teacher and teacher-training curricula can be reconstructed in the light of this knowledge. These studies have particular reference to conditions in Minnesota public schools and extensive visitation of such schools is a part of the program of work. One of these investigations is now in print. Others are in progress and still others are projected.

8. (With F. von Borgersrode.) Unit Costs of Instruction in the College of Education. (See abstract under the Bureau of Educational Research.)

9. See also the studies by W. C. Olson (Bureau of Educational Research), S. Dickinson (Department of Agricultural Education), W. E. Peik and G. A. Selke (Department of Educational Administration), and G. C. Hanna.

WILFORD S. MILLER, Ph.D., Professor of Educational Psychology.

1. The Variation and Significance of Intelligence Quotients Obtained from Group Tests. *Journal of Educational Psychology* 15:359-66. 1924.

2. The Classification of 6A Pupils into Ability Groups. *Proceedings of the Second Annual Conference of the Minnesota Society for the Study of Education*. 1:14-25. March, 1925.

3. An Objective Test in Educational Psychology. *Journal of Educational Psychology* 16:237-46. 1925.

4. See also the studies by J. E. Bohan, M. E. Boss, M. L. Edwards, A. W. Hurd, M. Miller, and G. G. Steinbrink; also that by M. S. Gold (Department of Theory and Practice of Teaching).

JOHN G. ROCKWELL, B.A., Assistant Professor of Educational Psychology.

1. Investigation of Qualitative Differences in the Reactions of Near Blind Children As Compared with Normal Children.

This research is conducted by H. W. Distad, H. E. Marshall, and O. L. Troxel, under the direction of J. G. Rockwell and A. H. Turney. The subjects to be used are children of the sight-saving classes in St. Paul and Minneapolis public schools. Two things will be attempted: (1) qualitative differences in reactions of near blind children to be determined; (2) attempt to construct a group intelligence test applicable to blind and near-blind children. Work unfinished.

2. Relation of Thyroid Deficiency to Learning in the White Rat.

The thyroid and parathyroid glands are removed from albino rats from eight to fifteen days old, with litter mate controls. Six weeks later the animals are put through learning situations, maze and problem box situations. Two weeks after completion of the original learning problems the animals are tested for retention or relearning.

Tentative results are as follows: (1) If the parathyroid tetany is controlled, a thyroidectomized rat soon shows grave effects of thyroid deficiency. In the space

of six weeks time, the controls will gain several hundred per cent more than the operated rats. (2) There seems to be a decided difference in emotional status, muscular activity, and sex activity. (3) There seems to be little difference in original learning between controls and operated animals as judged by time, errors, and trials required. (4) In relearning, the data indicate decidedly better retention in the controls.

### 3. The Pathogenesis of Parathyroid Tetany. (Unpublished.)

Both the thyroid and parathyroid glands are removed in rats and cats. The aim is to discover the specific type of change met in the resulting nervous reactions and some means for aborting or controlling the tetany. The results are as follows: (1) If rats are operated on at an early age (8 to 15 days), and if the mother's milk supply is adequate, tetany is less apt to ensue. (2) Following weaning, tetany can be fairly well controlled by a diet consisting of bread, milk, and lactose. (3) Calcium lactate, introduced by stomach tube, is effective in bringing cats out of severe tetany. This probably acts as a depressant and not as a cure, but if resorted to in conjunction with a diet, largely carbohydrate, consisting of bread, milk, and lactose, it seems, to date, to be very effective.

### 4. Relationship of Intelligence to Behavior Problems in Pre-School Children.

This work is being carried out with the co-operation of Doctors E. J. Huenekens, H. S. Lippman, and L. F. Richdorf upon children in the Minneapolis pre-school clinics. The testing is being done by students in the psycho-educational clinics. Cases so far tested seem to show that the intelligence ratings of problem cases are above normal. This is probably due to some selective factor rather than to a causal relationship between behavior difficulties and intelligence.

### 5. Investigation Concerning the Causes of Speech Defects in Young Children and Possible Methods of Correction.

The subjects are children having specific defects. These children are taken from the Minneapolis pre-school clinics. Work in progress.

MARVIN J. VAN WAGENEN, Ph.D., Assistant Professor of Educational Psychology.

1. (With Clifford Woody, University of Michigan.) Educational Scales for Measuring Spelling Ability and Abilities To Do the Fundamental Operations in Arithmetic.

(a) Van Wagenen Spelling Scales. Bloomington, Illinois: Public School Publishing Company. 1925. 25 pages.

(b) Woody Arithmetic Scales—Van Wagenen Revision. Bloomington, Illinois: Public School Publishing Company. 1925. 24 pages.

The method employed in the derivation of these scales was the same as that used in devising the Van Wagenen American history scales and the Posey-Van Wagenen geography scales. The scales indicate how difficult words a student can spell or how difficult tasks he can do in the fundamental operations of arithmetic with a correctness of 50 per cent.

### 2. Variability of Instructional Conditions in the Public Schools.

The plotting of variations from mental age norms for all pupils in each one hundred fifty classes on record cards showing quality of work and relation of scores to grade norms indicated a wide variability—from one to three years—from school to school in each subject of instruction as well as from subject to subject in many classes. An even distribution of emphasis from one phase of school work to another as well as a relatively uniform quality of work for all pupils in a class is the exception

rather than the general tendency. Wide differences in quality of work as well as in achievement are evident from one school system to another and also from one school to another in the same system. As compared with the standards for the system, an exceptionally poor quality of work in certain phases of instruction is seldom accompanied by an unusually good quality of work in other phases of instruction.

### 3. Determination of Standards of Achievement on the Basis of Items in Educational Scales Considered Unessential.

School superintendents, principals, and teachers of experience were asked to indicate all the items in two educational scales in geography and American history which they considered of no value to the poorest pupils in the upper quarter of the eighth grade, to the median pupils and to the best pupils in the lower quarter of the eighth grade in their business, social, and reading functions as adults. When the scores were determined in the usual way of finding a pupil's score in an educational scale of the C score type, the median scores of approximately eighty competent people were nearly identical from one scale to another in the same subject. The results indicated that variation in needs is considered even wider than variations in capacities for achievement. The present norms for American history are considered adequate, but in geography half a year's work beyond the present seventh grade attainment is considered advisable.

### 4. Comparison of the Mental Ability and School Achievement of Bright and Dull Pupils in the Sixth Grade of a Large School System. *Journal of Educational Psychology*, 16:186-92. 1925.

The comparison was made on the basis of median mental ages, median achievement quotients, and median achievement scores in spelling, reading for comprehension, the information and thought phases of American history, the information and thought phases of geography, the fundamental operations of arithmetic and arithmetic problems of the lower and upper one-thirteenth of the sixth grade of a large school system. In median mental ages the two groups in the same grade differed by approximately four grades. In reading and the thought phase of American history the differences were just about as great. In all other phases of instruction except spelling the differences were around three grades but in spelling the difference was only two grades. In reading and the thought phase of American history the gifted pupils did as good a quality of work as the less gifted and nearly as good a quality in the thought phase of geography and arithmetic, and in the information phase of American history. In the information phase of geography the gifted pupils did a poorer quality of work than the less gifted and in spelling and the fundamental operations of arithmetic a decidedly poorer quality of work.

### 5. Determination of the Range of Information of University Freshmen in Geography and American History.

On the basis of educational scales in geography and American history given to several hundred students at entrance the median scores were determined for the men and women separately and compared with the grade norms of the elementary school. In geography the freshman women possess about a sixth grade level of information, the men approximately a seventh grade level. In American history the women stood as far below the eighth grade norms as the men stood above them. But little difference is noticeable among the students who took a half year or a whole year course in American history in high school or among the students who took their work in American history during the junior or senior year in high school.

### 6. Verification of the Assumptions Underlying the Method of Constructing the C Score Educational Scales. To be published in the *Teachers College Record*, September, 1925.

The method consisted of the determination of the closeness of fit to a normal probability curve of the curves resulting from the measurement of the 1,200 eighth grade pupils in a large city school system in the case of the information and thought phases of American history, and the determination on the basis of from 300 to 400 cases of the closeness of fit to the theoretical curve of the curves obtained from calculating the per cents of correct responses on either side of the 50 per cent level of correctness in the case of a spelling scale and a scale for measuring range of information in American history.

In the case of the distribution of scores in the thought scale in American history for the eighth grade pupils of a large school system, the chances for a random selection of a similar number of cases from a normal distribution approximating the normal probability curve more closely are only two out of five and in the case of the information scale the chances are only one out of five. The average amount by which the per cents of correct responses differ from the predicted amounts above and below the 50 per cent level was found to be only 2.6 per cent in the case of the information scale in American history and only 2.1 per cent in the case of the spelling scale.

7. The Measurement with Educational Scales of the Gains in Achievement Made by Elementary School Pupils in All Phases of Instruction. Work in progress.

8. The Determination of Standards of Achievement in the Freshman Course in College Rhetoric. Work in progress.

9. See also the studies by R. E. Atkins, L. B. Kinney, and M. M. Shannon; and that by S. A. Hubman (Department of Theory and Practice of Teaching.)

JOHN E. BOHAN, M.A., Assistant in Educational Psychology.

Student's Marks in University Courses. (Thesis to be offered for the Ph.D. degree; W. S. Miller, Adviser.)

A study of the distribution of marks in various courses, to determine their reliability, significance, and fairness. The prophetic value over a four-year period of certain mental tests and reading tests given to entering freshmen is also included. The material consists of official records of University of Minnesota marks and records of tests given in the fall of 1921 to entering freshmen. The method is largely statistical. This investigation is carried on in connection with the work of the Subcommittee on College Marks of the Committee on Educational Research of the University of Minnesota. Work in progress.

AUSTIN H. TURNER, M.A., Assistant in Educational Psychology.

1. A Study of Factors Other than Intelligence That Affect Success in the High School As Indicated by Teachers' Marks. (Thesis for the M.A. degree; W. S. Miller, Adviser.)

The cases were selected from all four years of the University High School, on the basis of discrepancy between achievement and capacity. Method includes use of rating scales, visitation, questionnaire securing information regarding physical, educational, and social conditions, and attempts to determine children's interests through their own testimony. The result indicates that marks in the High School are distorted by factors other than achievement, interfering with evaluation of character traits. Results from rating scales indicate that industry, perseverance, and accuracy are correlated positively with achievement; personal attractiveness, health, and respect for



authority apparently do not greatly affect the marks. Interests in reading, sports, and school activities as testified to by the subjects give no indications of causal relationships.

2. See also the study listed under J. G. Rockwell.

RUTH E. ATKINS, M.A., Graduate Student.

An Analysis of the Phonetic Elements in a Basal Reading Vocabulary. (Thesis for the M.A. degree; M. J. Van Wagenen, Adviser.)

The problem was to determine whether the words of most common occurrence in reading are sufficiently phonetic to make the establishment of bonds between printed elements and certain sounds a possible aid to a child who is learning to read. The first twenty-five hundred words of the Thorndike word list were analyzed. Although they are mainly unphonetic, certain symbols occur with sufficient frequency and high phonetic rating to make them of possible utility. This brief list should be tried out in actual school room situations to determine the true value of phonetic instruction as an aid to reading.

MABEL E. BOSS, B.S., Graduate Student.

The Relation of Performance on Mental Tests to Achievement in High School English. (Thesis to be offered for the M.A. degree; W. S. Miller, Adviser.)

MARY L. EDWARDS, B.S., Graduate Student.

An Investigation of Some of the Factors Causing Discrepancy between Intelligence As Shown by Mental Tests and Accomplishment As Shown by School Marks. (To be offered as a thesis for the M.A. degree; W. S. Miller, Adviser.)

Observations on the ninth grade pupils in the Roosevelt Junior High School, Minneapolis. A survey of the character, traits, health, interests, social and economic status of those high school students whose achievement exceeds or falls short of, by as much as once the standard deviation of the group, 'the mental ability' as determined by intelligence tests.

G. C. HANNA, B.A., Superintendent of the Minnesota School for Feeble-Minded and Colony for Epileptics.

Occupational Efficiency of the Mentally Defective. (M. E. Haggerty, Adviser.) Educational Monograph Number 7, *Bulletin of the University of Minnesota*, Volume 27, 1924. v, 48 pages.

This study is based on material from the Minnesota School for Feeble-Minded and Colony for Epileptics. Mental tests of four hundred inmates in the "school department" are checked against the occupational activities in which these "pupils" are engaged in which ratings of efficiency are available. The results show that the "mental age" of the inmates is a reliable index to their occupation possibilities.

ARCHER W. HURD, M.S., Graduate Student.

1. A Study of the Relative Value of the Topical versus the Problem Method in the Acquisition of Information on the Subject of Heat in High School Physics, with Its Implications. *University of Minnesota Educational Research Bulletin*, 28:3-9. January, 1925. (Thesis for the M.S. degree; W. S. Miller, Adviser.)

2. Observations on Factors Determining Success in Physics. (W. S. Miller, Adviser.) *School Science and Mathematics*, 25:121-31.

### 3. Objective Tests for Measuring Achievement in High School Physics. (W. S. Miller, Adviser.)

Tests formulated and in process of standardization.

### 4. Factors Other than Intelligence That Determine Success in Physics at North High School, Minneapolis. (W. S. Miller, Adviser.)

A survey of character traits, health, interests, social and economic status of high school students whose achievement in physics exceeds or falls short of, by once the standard deviation of the group, their mental ability as determined by intelligence tests. Work in progress.

LUCIEN B. KINNEY, M.A., Graduate Student.

### Standardized Tests in Commercial Arithmetic. (Thesis for the M.A. degree; M. J. Van Wagenen, Adviser.)

The preliminary tests were given in the four high schools and junior high school in the city of St. Paul to approximately 1,000 pupils in all. From the problems given in these tests four scales of problems were constructed. A test was also standardized to measure the speed and accuracy in the fundamental operations, as special methods in these operations are taught in the first semester.

A study of the relation between intelligence and achievement in the tests was made. Two methods of grouping, by I.Q.'s and by grade achievement, were compared. The results of the study make available a series of tests that will be valuable as a means of setting up standards of achievement, working out a method of classifying pupils, measuring teaching efficiency, and evaluating methods of instruction.

MAXINE MILLER, B.S., Graduate Student.

### Progress of Achievement in Art Education. (To be offered as a thesis for the M.A. degree; W. S. Miller, Adviser.)

To develop methods for predicting achievement in art education for the purpose of advising students contemplating work in this field.

M. MAE SHANNON, B.A., Graduate Student.

### Relation between Tests and Achievement in English. (To be offered as a thesis for the M.A. degree; M. J. Van Wagenen, Adviser.)

The purpose was (1) to evaluate the university English entrance examinations, in comparison with the grades received by students during the freshman year; (2) to ascertain the value of the Kelley-Trabue Completion Test as a means of predicting a student's achievement in English; and (3) to compare the results of the English entrance tests with such items of the intelligence tests as are related to ability in English.

GERARD G. STEINBRINK, M.A., Graduate Student.

### Some Theoretical and Practical Implications of the Measurement of Intelligence. (To be offered as a thesis for the Ph.D. degree; W. S. Miller, Adviser.)

## EDUCATIONAL SOCIOLOGY

ROSS L. FINNEY, Ph.D., Assistant Professor of Educational Sociology.

### The Social Aspects of the Teacher's Job.

To ascertain from experienced superintendents the maladjustments in the social aspects of their jobs by which inexperienced teachers most often undermine their usefulness. The material was tabulated from letters received in reply to a letter of inquiry

sent out to about one hundred superintendents, replies being received from twenty-eight. The reasons assigned for maladjustment were grouped under various headings. Those relating to participation in the organized community activities were most frequently mentioned, but unsatisfactory relations with the pupils was a close second. Other topics (in order of frequency) were: moral and quasi-moral deportment; general attitude toward the community; relations with patrons and citizens; relations with colleagues; room, board, dress, etc.

## HOME ECONOMICS EDUCATION

WYLLE B. MCNEAL, M.A., Professor of Home Economics and Chief of the Division of Home Economics.

Analysis of the Teacher Trainer's Job in Home Economics Education. This study was made with the co-operation of Edna P. Amidon, Carlotta M. Brown, Aura I. Keever, Paulena Nickell, Elizabeth A. Rivers, Iva I. Sell, and Louise Soby.

The teacher trainer's responsibilities are set up as follows:

1. To train potential teachers to (a) gain command of subject-matter; (b) select and organize subject-matter to meet their needs; (c) develop satisfactory methods of teaching and testing; (d) establish satisfactory standards of skill and management; (e) develop professional interest and ability to recognize professional responsibility; (f) improve personal characteristics.
2. To maintain co-operative relationships with (a) state supervisor of home economics education; (b) subject-matter instructors in institution; (c) school systems in which student teaching is done; (d) educational psychology department in conducting studies and experiments; (e) those responsible for vocational guidance.
3. To keep up-to-date professionally.
4. To discharge necessary administrative duties.
5. To be informed on the organization, administration, and relation to teacher training institutions and schools of the state, of the Federal Board and State Board of Vocational Education and State Department of Education.

These responsibilities have been analyzed in detail as to (a) problems involved; (b) ways and means of solving problems; (c) difficulties likely to be encountered in the solution; and (d) how difficulties may be overcome.

This analysis is expected to serve as a basis for the development of courses designed to train people for positions in teacher training work in home economics education, since for such positions no curricula are now set up in any institution.

## THEORY AND PRACTICE OF TEACHING

EARL HUDELSON, Ph.D., Professor of Education.

### 1. Objective Tests in High School Literature.

A prolonged experimental derivation of tests on high school literature which will measure as many as possible of the elements that subjective tests now attempt to measure.

### 2. A Pupil-Activity Curriculum for High Schools.

An acceptable selection of the important specific abilities which contribute to the realization of both the immediate and ultimate aims of secondary education is now available for administrators. But it does not solve the classroom teacher's curricular problems. This study attempts to do that. It lists in what several hundred administrators, supervisors, and teachers consider a descending order of social importance the feasible high school pupil activities which are best adapted to give pupils the abilities necessary for the realization of the aims of education. It then lists under each activity that subject-matter which will best stimulate the activity and throw light on how best to learn to perform it. Work unfinished.

### 3. The Effect of Objective Standards upon Composition Teachers' Judgments. (Unpublished.)

A report of a series of experiments showing the effects of the use of objective composition scales upon the accuracy, stability, and unanimity of English teachers' judgments of composition merit. Practice in the use of objective standards of pupil achievement in English composition renders teachers' judgments more accurate and constant at the same time that it makes them more receptive and sensitive to refinement; enables teachers to classify pupils more confidently and to detect composition improvement more reliably; appears to give English teachers moral support in assigning marks justly; tends to have rationalizing influence upon English teachers, often revealing to them a presumptuously high opinion of their powers of discrimination and an exaggerated sense of differences in composition merit; and curbs erratic judgments as well as corrects consistent errors of judgment. The ability to learn to use objective composition scales reliably furnishes some indication of intelligence. Teachers whose accuracy on subjective standards of composition quality, is highest generally learn to use objective standards most rapidly and reliably.

### 4. Diversity of Teacher Judgment upon Standards of Content and Achievement in English. To be published in the *Teachers College Record*, 1925.

An investigation the results of which reveal a wide disagreement among high school English teachers as to the proper content and reasonable achievement of high school pupils in English literature and English composition.

5. See also the studies by B. Hayes, E. R. Challman, A. Ginsberg, M. L. Norem, O. L. Troxel, A. C. Gaardsmoe, and B. Waite.

SOPHIA A. HUBMAN, M.A., Instructor in German, University High School.

#### 1. Reading Test in German. (M. J. Van Wagenen, Adviser.)

For the purpose of arranging objective reading scales in modern foreign languages. The Modern Foreign Language Study Committee, working under the Carnegie Foundation, is engaged in a series of research problems for which effective measuring scales are needed. This reading scale is being prepared as one of several done by the committee or under their direction. Work is also being done independently on a composition efficiency test, a kind of functional test of the speed and accuracy of the students use of the language.

#### 2. Wastes in Modern Language Teaching. *Modern Language Journal*, November, 1924.

Experimentation particularly as to economy to be gained in arrangement of grammatical material.

#### 3. The Business of Getting a Vocabulary. *Modern Language Journal*, December, 1924.

The study included the size of the vocabulary, the method of presenting the words, and the method of learning. The results and conclusions are too extensive for a brief abstract.

#### 4. Vocabulary Teaching and Learning. To be published in the *Modern Language Journal*, 1925.

Students were tried on ten-word, twenty-word, and fifty-word vocabularies. It was found after three weeks of experimentation that the ten-word vocabulary gave least return. The variations in learning ability, the steps in the learning process, most economical methods, etc., were studied.



5. Differentiation in Reading Technic in Alpha and Beta Groups. To be published in the *Modern Language Journal*, 1925.

It was found that the methods used for a strong class brought only confusion when used with a weak division. The methods of teaching best adapted to the two classes are considered in detail.

MARY S. GOLD, M.A., Instructor in History, University High School.

#### 1. Supervised Study Method. (W. S. Miller, Adviser.)

The purpose is to devise a method suitable to a short unit of work planned and taught by student teachers. The topics studied included the crusades, medieval books and science, and the partition of Africa. Textbook, collateral reading, illustrative material, maps. The work was arranged in C, B and A groups: C, textbook material only; B, topics based on outside reading; A, some original work and a topic on present-day material related to unit. Results so far suggest a gain over question and answer recitation to slow pupils in the third and fourth years, but a loss to slow pupils in the first and second year classes.

#### 2. Vocabulary Test for Ancient and Medieval History.

The purpose is to ascertain what extent a vocabulary, useful in more advanced history, civics, economics, or for general use, can be taught effectively through ancient and medieval history in a one-year course in high school. The test was given to thirty sophomores who had had the history and to thirty who had not. The result showed the median and mean number of errors one half as great in history group as in the other group. There is some correlation with the I. Q. Findings are possibly of direct use in subsequent teaching, but further work on the problem is necessary.

LEONARD D. HAERTLER, M.A., Instructor in Mathematics, University High School.

Training of Student Teachers in Universities and Colleges of America.  
(Under the direction of C. W. Boardman.)

Questionnaires were sent to thirty-three of the universities and colleges of America, to determine the amount and character of the work in student teaching. Data were obtained as to the amount of credit given; the length of the course; character of conferences held; method of rating; extent of supervision; amount of student teaching; types of lesson plans; grades; and difficulties encountered.

REWEY B. INGLIS, M.A., Instructor in English, University High School.

An Occupational Analysis of the Work of the Teacher of English in the High Schools of Minnesota.

The study is conducted by personal interview and questionnaires.

The purpose is to answer the following questions: (1) What are the most important activities, both in and out of class, required of teachers of English? (2) How far does the present training of teachers at the University of Minnesota fit students for the work which they are called upon to do in actual practice? (3) What is the relative value of courses in other subjects to teachers of English? (4) What conditions will the prospective teacher be likely to face in the way of equipment, special community interests and problems? (5) How may such student be better prepared to meet these conditions? (6) Are there any common practices in the teaching and administration of English which need reform?

During the spring quarter of 1925 data have been secured from 41 schools, 137 teachers, 45 administrative officers, and about 60 librarians and booksellers. The report is now being prepared.

HERBERT E. MARSHALL, M.A., Assistant in Theory and Practice of Teaching.

1. Diagnostic Tests of Arithmetical Problem Solving Ability. (Thesis for the M.A. degree; L. J. Brueckner, Adviser.)

The new tests have for their content sets or groups of related problems centering around two child-life situations: the sleigh ride situation and the radio situation. A high diagnostic value is made possible by breaking the problem solving process into its constituent steps which are five in number. By means of a multiple response technique the pupil's response to each of these steps is recorded.

Analysis is made of the results of giving these tests to nearly ten thousand children of the fourth to the seventh grade in the Minneapolis schools. The detailed conclusions are too extensive for brief summary. In general, it is concluded that possibly tests can be constructed which have high diagnostic value and which meet statistical criteria. The writer's Test A does this very satisfactorily for grades IV B and IV A.

2. See also the study listed under J. G. Rockwell, Department of Educational Psychology.

SAMUEL R. POWERS, Ph.D., formerly Instructor in the University High School.

A Diagnostic Study of the Subject-Matter of High School Chemistry. *Teachers College, Columbia University Contributions to Education*, Number 149. (Thesis for the Ph.D. degree; M. E. Haggerty, Adviser.)

This study attacks the problem of the suitability of the subject-matter of chemistry for the curriculum of secondary education. A study was made of a wide range of informational and problem items and these were submitted in the form of tests to high school and college students throughout the country. The resulting data afforded material for the study of the following problems: (1) the difficulty of the items; (2) the achievement in different schools; (3) the length of time students retain the facts of chemistry; (4) the achievement of university students. The items were evaluated in terms of difficulty and were thrown into scale form for use in further investigation.

WILLIAM D. REEVE, Ph.D., formerly Instructor in the University High School.

A Diagnostic Study of the Teaching Problems in High School Mathematics. (Thesis for the Ph.D. degree; M. E. Haggerty, Adviser.)

The basis of this study was a course in general mathematics designed for the first year high school students. This course was organized and developed to meet the current objections to mathematics as a required high school subject. From the course as developed the investigator selected items from each of the several chapters and constructed tests with which to measure both the general progress of pupils and the specific difficulties which pupils encounter in learning mathematics. The specific difficulties thus analyzed and defined were made the basis for devising the techniques for remedial teaching. The investigation as reported in its initial stages provides a series of standardized tests and scales for diagnostic purposes.

ALMA C. GAARDSMOE, B.A., Graduate Student.

1. A Study of the Value of Supplementary Drill in Factoring. (Under the direction of Earl Hudelson.)

The mathematics teachers of the Twin Cities feel that the adopted textbook in algebra does not provide sufficient drill material in factoring. An experiment was carried out in six classes in algebra in the Central High School, St. Paul. Each of three teachers had one control group and one experimental group. The pupils in

her two groups were paired as to intelligence, scholarship, and age. No unpaired pupils figure in the results. Daily supplementary drill exercises were devised. Drill in the control groups was limited to the textbook exercises. The experimental groups practiced daily on both the textbook and the supplementary exercises. The extra-drill sections averaged two points higher than the textbook sections on a twenty-five-point test. The optimum amount of supplementary drill has not yet been determined.

2. See also the study listed under the Department of Educational Administration.

ANNIE GINSBERG, B.S., Graduate Student. Teacher in Mechanic Arts High School, St. Paul.

Minnesota Tests of Minimum Essentials in English. (Under the direction of Earl Hudelson.)

Three comparable forms of an objective test covering the essentials of mechanics in English composition were devised and administered to 40,000 junior and senior high school pupils in Minnesota. The tests were then refined and are now being given to several thousand pupils throughout the country. Upon the basis of these returns at least two comparable forms of the test will be standardized and published by Miss Ginsberg and Miss R. B. Inglis, University High School, Minneapolis, Minnesota.

BRIDGET HAYES and ESTHER R. CHALLMAN, Graduate Students. Teachers in the Minneapolis Schools.

Self-Testing Exercises in English Grammar. (Under the direction of Earl Hudelson.)

The purpose of the study was to devise methods whereby some of the routine work of the English teacher can be transferred to the pupil, thereby releasing the teacher for more constructive work or for the handling of larger classes. Numerous drill exercises based upon the fundamentals of grammar are provided. Keys are supplied whereby the pupil is able to check his work quickly, to watch his improvement, and to analyze his weaknesses and concentrate upon them. The scheme is adaptable to any text on grammar.

MARGARET L. NOREM, B.A., Graduate Student.

The Value of Outline Maps in the Teaching of High School History. (Under the direction of Earl Hudelson.)

The use of outline maps in high school history classes is widespread and entails the expenditure of much time, effort, and money. This study was designed to test objectively the results of various uses of outline maps in the teaching of history. Pupils were paired as to intelligence, and one section used outline maps while the other did not. Tests have been devised to measure the relative progress of the two sections. The study is unfinished.

ROGER M. PEET, B.S., Graduate Student.

An Analysis of Specific Addition Abilities. (To be offered as a thesis for the M.A. degree; L. J. Brueckner, Adviser.)

The purpose is to analyze errors and difficulties in arithmetic where the same combination is used in examples and problems. The method of determining errors and difficulties is statistical, based on original arithmetic tests. These tests include the twenty most difficult addition combinations. In one set of problems the combinations to be added are in numeral form, in another set, the numbers are written as words. Work in progress.

OLIVER L. TROXEL, M.A., Assistant in Education.

1. The Value of Pupil Use of General Merit English Composition Scales. (Under the direction of Earl Hudelson.)

If pupils can profit by the use of composition scales in their own hands, English teachers will be relieved of some of the work of scoring themes and will thus be enabled to devote this time to more constructive work or to larger classes. This experiment is the first unit of a series of studies designed to ascertain whether pupils can learn to use general merit composition scales profitably and, if so, how. The experiment is not yet completed.

2. See also the study listed under the Department of Educational Administration.

BEATRICE WAITE, Undergraduate Student and Teacher of Stenography in the Minneapolis Schools.

The Value of Home Practice in Stenography. (Under the direction of Earl Hudelson.)

In addition to their classroom practice in writing from dictation, stenography pupils are often assigned home practice in transcribing printed pages into shorthand. This experiment was designed to test the relative values of the two practices. Pupils in two beginning classes in stenography were paired as to intelligence. One class spent the full period daily for six weeks in writing from dictation. The other section spent the last fifteen minutes of each daily period for six weeks in transposing the same material from the printed page into shorthand. Two comparable forms of an objective stenographic test were devised. One test was given to both sections in mimeographed form at the end of the experiment; the other test was dictated to both. Both groups did significantly better on the dictated test than they did on the mimeographed test. The dictation group scored higher on the mimeographed test, and far excelled the other class on the dictated test.

## TRADE AND INDUSTRIAL EDUCATION

CHARLES A. PROSSER, Ph.D., LL.D., Professor of Trade and Industrial Education.

1. Studies Made in the Seminar in Vocational Education During the Scholastic Year 1924-25.

By A. D. BAILEY. A Study of Problems of Discipline in a Boys' Vocational School.

By G. W. HAVERTY. A Study of the Kind of English That Would Be Most Effective for the Type of Student That Enrolls for Training at Dunwoody Industrial Institute.

By V. A. JOHNSON. A Study of the Scheme for Industrial Training in the St. Cloud Reformatory.

By M. C. KENT. A Study of the Possibilities of a Museum for Industrial and Trade School.

By D. M. SCHWEICKHARD. Measurement of Standards in Industrial Education by Means of a Standard Scale.

By H. W. TEICHROEW. Tests and the St. Paul Vocational School.

A study of the possible usefulness of mechanical aptitude tests as indicated by results at the end of one year.

By R. W. WHITE. Trade Mathematics for Plumbers.



By R. A. WIGEN. A Study of Mechanical Drawing to Function for High School Students.

By R. R. WILCKEN. A Study of Industrial School Floors.

Analysis of the possibilities to meet the complex problem of a suitable floor in an industrial school due to varied conditions.

By W. A. ZIEGLER. Some Results of Psychological Testing in the Rehabilitation Work of the U. S. V. B. in Minneapolis.

2. See also the study by R. T. Craig.

RALPH T. CRAIGO, B.S., Instructor in Trade and Industrial Education.

Development of Trade Finding Courses and of Trade Standard Performance Tests.

This work is being carried out at the Dunwoody Institute under the direction of C. A. Prosser. Work still in progress.

HOMER J. SMITH, M.A., Instructor in Trade and Industrial Education.

Industrial Education in the Public Schools of Minnesota. A Detailed Study of Its History and Present Practice, with Suggestions. Foreword by Dean M. E. Haggerty. Educational Monograph No. 6. *Bulletin of the University of Minnesota*, Volume 27, Number 47. 153 pages.

This study is an occupational analysis record for the formulating of a teacher training program in industrial education, both general and vocational. It answers the question: "What are the students whom we presume to train for teaching called upon to know and to do, once they have left the University and are employed by Minnesota boards of education for service?" Three hundred forty-nine interviews were held and one hundred ten teachers were seen at work.

The several chapter headings follow: The Growth of Industrial Work in the Public Schools during Thirty Years; A General Survey of the Work in Sixty-five Representative Systems; Equipment, Course Materials, and Physical Product; Methods, Classroom Management, and the Informational Element; Miscellaneous Related Activities; Our Objectives and the Means of Their Attainment; The Industrial Teachers' Job and Present Preparation As Indices of Teacher-Training Responsibilities.

# THE SCHOOL OF BUSINESS

## ACCOUNTING

HARRY J. OSTLUND, B.A., Assistant Professor of Accounting.

### 1. Research in Retail Drug Store Operation and Costs.

The purpose is to discover what are the factors that affect efficiency in retail drug store operation and to measure, so far as possible, the effect of those factors. The method pursued is that of getting very complete information concerning the financial status and operating expenses of druggists by means of a questionnaire. The report will cover fully all the important cost and merchandising aspects of drugstore operation. The research is being conducted in co-operation with the Northwestern Pharmaceutical Bureau, and is a continuation of similar work done in 1923. To be published during the early part of 1926.

2. Cost Analysis for Various Purposes. (To be offered as a thesis for the Ph.D. degree at the University of Chicago.)

The purpose is to develop costs of conducting a business enterprise, and to make possible the compilation of any cost information that may be needed for any purpose whatever. The plan of the study includes: (1) a study of the various uses now made of cost information such as price setting by individual producers or public authority, the determination of business policies, planning business activities, and the determination of the efficiency of certain business methods; (2) a statement of the present conventional methods of cost analysis, with a criticism stating their deficiencies or limitations; (3) a statement of the factors affecting cost, which factors must be regarded in developing an adequate cost analysis; (4) a suggested method of analysis that shall meet the needs as indicated and which shall have regard for the factors that affect cost.

## ECONOMICS

FREDERIC B. GARVER, Ph.D., Professor of Economics.

### 1. (With A. H. Hansen.) Principles of Political Economy.

Research in progress during the year 1924-25 has been incidental to the writing of a general treatise on economics, in collaboration with Professor Hansen. In this work, the attempt has been made to restate and to modify the usual treatment of the theories of value and of distribution so as to take account of (1) recent statistical investigations of the distribution of the national income; (2) the later and more detailed concrete studies of price making; and (3) new developments in allied social sciences. The work is three-fourths complete, as nearly as can be estimated.

2. See also the study by J. M. Mahoney.

ALVIN H. HANSEN, Ph.D., Professor of Economics.

1. Wholesale Prices, 1801-1840. *Journal of the American Statistical Association*, 19:377-81. 1924.

2. Factors Affecting the Trend of Real Wages. *American Economic Review*, 15:27-42. 1925.

3. The Effect of Price Fluctuations on Agriculture. *Journal of Political Economy*, 33:196-216. 1925.

#### 4. The Effect of Unionism on Wages and Hours.

The purpose of this study is to measure statistically the influence of unionism on the conditions of labor. Index numbers of wages and hours of seven or eight crafts, which have become strongly unionized during the last forty years, have been constructed from a mass of bulletins. These will be compared with index numbers of wages and hours of common labor. The data goes back to 1860 and in some cases to 1840. These index numbers should make possible a comparison of the differentials that have developed during the last eighty years between the skilled crafts and common labor as well as between the skilled crafts themselves. Work in progress.

#### 5. Principles of Political Economy. (See abstract under F. B. Garver.)

6. See also the studies by H. A. Phelps (Department of Sociology), R. A. Graves, D. McCracken, W. H. Stead, and W. B. Taylor.

ROLAND S. VAILE, M.A., Associate Professor of Economics.

#### 1. A Study of Marketing Middlemen in the Grocery Field in the Twin Cities.

a. A part of this project is included in the thesis by C. J. Ratzlaff. (See separate abstract.)

b. This study was conducted as a class research problem in the Economics Seminar 181C (1925) concerning the purchasing sources for retail grocery stores in Minneapolis. Included in the study, there were 45 cash and carry stores and 55 stores which permitted charge accounts and deliver. Data were gathered and analysis made regarding (a) size of store, (b) stock turn, (c) number of sources from which stores purchased supplies, (d) frequency of purchase, (e) dominant reason for purchasing from particular agencies. A summary of this material has been published in the *News Letter of the Minneapolis Civic and Commerce Association*.

#### 2. A Study of the Buying Habits of Housewives in Southeast Minneapolis.

Class research problem in the Economics Seminar 182C (1924). This study involved the collection and analysis of data concerning the sources from which householders purchased their supplies of groceries, hardware, and drugs in Southeast Minneapolis. Proportion of articles purchased in the downtown district as compared to the decentralized stores was determined as well as the buying motives which appear to control these habits. A summary of the results of this study in regard to grocery purchasing was published in the *Northwest Commercial Bulletin* for November 1, 1924, pages 23-25.

#### 3. Trade Association Activities in the Twin Cities.

Class research problem in the Economics Seminar 182C (1925). This study of trade associations is made to cover the following general points: (a) general organization, including a code of ethics and the affiliation of district or national associations; (b) political and protective activities; (c) specific services such as co-operative advertising, accounting, credits and collections, etc.; (d) association research.

Especially attention is being given to the following associations: Northwest Lumbermen's Association; St. Paul Retail Grocers' Association; Minnesota Retail Hardware Association; Minnesota Retail Drug Association; Minnesota Retail Shoe Association; Minnesota Retail Furniture Association; The Retail Research Association; Associated Merchandising Corporation; National Wholesale Grocers' Association.

#### 4. Pricing Policies within Representative Industries.

Class research problem in the Economics Seminar 182C (1925). This study included (1) the meaning and economic analysis of the term "uniform prices"; (2) an analysis of manufacturers' pricing policy in various industries in relation to uniform

prices, including (a) the apparent uniformity of quoted prices, (b) the use or avoidance of open list prices, (c) the agreement of prices with those published in trade journals, (d) time and quantity discounts, (e) disposition of freight charges, (f) price difference which different disposition of freight charge would make.

The following commodities were included in the study: flour, sugar, canned goods, road machinery, shoes, lumber, furniture, automobiles, cotton yardage, men's suits, Rexall drug products.

### 5. The Industrial Market Possibilities of the Twin Cities.

Personal research problem. In this study, an attempt is made to determine the sources of raw materials available for industry surrounding the Twin Cities. The factors of comparative advantage which determine the development of these raw material sources in contrast to the importing of manufactured products from elsewhere are being considered. Purpose of this study is to furnish illustrative material for use in the marketing classes.

JOSEPH E. CUMMINGS, M.A., Assistant Professor of Economics.

Economic Aspects of Railway Consolidation in the West. (Thesis to be offered for the Ph.D. degree at the University of Chicago.)

The consolidation of the railways of the continental United States into a smaller number of systems is apparently accepted government policy. In this case it seems desirable to analyze the economic conditions which should be considered in building up such consolidated systems. This study is confined territorially to the so-called "transcontinental" lines, lying roughly west of Chicago and the Mississippi River. The question of the desirability and expediency of the general policy of railway consolidation is not discussed—that is considered to be logically a separate problem. The material is found chiefly in (a) *The Tentative Plan of the Interstate Commerce Commission for the Consolidation of the Railways of the United States into a Limited Number of Systems* (published August 3, 1921); (b) testimony, exhibits, and briefs presented before the commission in its hearings on the tentative plan from April 24, 1922, to February 9, 1924.

WARREN C. WAITE, Ph.D., Assistant Professor of Economics.

### 1. Interrelationship of the Prices of Different Grades of Agricultural Products.

Studies of the prices of agricultural products commonly neglect the fact that there are many qualities of the product in the market, and in consequence, there are many different prices at the same time. This project is primarily concerned with the discovery and analysis of these interrelationships, first of the prices of the different grades of certain agricultural products in particular markets, and second, the relationships between the prices of similar grades in different markets. The method of attack has been the calculation of differentials on certain days of the week, for a considerable period of time, from published price quotations. The principal products included in the study are cash wheat, the wheat options, livestock, and butter. A number of additional products will be included. The preliminary studies show a marked regularity of seasonal change in these price relationships both within a particular market and between markets.

### 2. The Price Making Mechanism of the Central Market. (Thesis for the Ph.D. degree; J. D. Black, Adviser.)

### 3. Market Price Analysis. *Journal of Farm Economics*, 6:351-59. 1924.

JOHN F. EBERSOLE, Ph.B., M.A., Professorial Lecturer in Economics.

Statistical and Economic Analysis of Agricultural and Business Conditions in the Ninth Federal Reserve District. Published in part in the



*Monthly Review of Agricultural and Business Conditions in the Ninth Federal Reserve District*, by the Federal Reserve Bank of Minneapolis. 3:49-148.

The object is to assemble from original sources reliable data covering past years for the purpose of computing and eliminating seasonal and secular trends in order to interpret current business statistics with reference to the residual or cyclical variations. The material developed and utilized in this work is here presented in four groups.

Group I. Monthly Data Reported Directly from Original Sources.

The volume of business based on: (a) individual debits at banks in seventeen cities; (b) shipments, cut and stocks of lumber manufacturers; (c) classified sales in wholesale trade; (d) sales, stocks, and outstanding orders of department store retailers; (e) retail lumber sales of approximately seven hundred yards located throughout the district; (f) mining production of copper, silver, gold, and coal; (g) employment conditions, based on ratio of advertisements and on numbers employed by lumber manufacturers and mining companies.

Housing conditions, as reflected by advertisements; and prospective building activity, as shown by building permits granted by eighteen reporting cities.

Price trends based on: (a) median cash prices of six different grains and of flour at Minneapolis; (b) median cash prices for several varieties of livestock at South St. Paul; (c) wholesale produce prices at Minneapolis.

Banking conditions shown by: (a) weekly condition reports of twenty-five selected member banks; (b) interest rates charged at selected Minneapolis banks; (c) the volume of commercial paper outstanding in this district; (d) savings deposits as reported monthly by selected banks; (e) the rediscounts of the Federal Reserve Bank in the different states; (f) sales of securities by selected firms located in the Northwest; (g) collections as experienced by both retailers and wholesalers.

Group II. Current Business Statistics Derived from Secondary Sources.

Grain, livestock, and coal receipts at terminals, grain stocks, flour production, iron ore shipments, car loadings, business failures, crop prospects, and contracts awarded for building.

Group III. Special Studies.

Forecasting chart concerning urban business conditions in this district, published July 28, 1924.

Rural banking conditions in the different counties of this district, in the years 1922, 1923, and 1924, illustrated with maps, published August 28, 1924.

Graphic survey of agricultural and financial conditions in the Ninth Federal Reserve District, with maps and charts exhibiting the following:

Mutation of wheat, corn, and flax acreages between 1919 and 1923.

Variations in the valuation of farm lands compared with corn and wheat production in 1922.

Bank loans, deposits, and borrowings of all banks in this district and for the several states.

Dockage in spring wheat in 1923 as a percentage of the total wheat yield in each county.

Swine, cattle, and sheep on farms in 1922, with reference to density, or number of head per square mile.

Typical interest rates paid in each county on time deposits by national banks in June, 1923.

Wheat yields per acre in different counties during the crop years 1921, 1922, 1923, and 1924.

Bank credit conditions in different counties as determined by the ratio of loans to deposits for June 30 of each of the years 1921, 1922, 1923, and 1924.

A study by counties of federal seed loans distributed in this district in 1921 and 1922. Published September 27, 1924.

An analysis of foreign demand for United States foodstuffs. Published November 28, 1924.

A general survey of the financial effects of this year's crop. Published December 27, 1924.

Financing long term credits to agriculture by the use of state credit in South Dakota and Minnesota. Published January 28, 1925.

Survey of banking developments in the Northwest during 1924. Published March 28, 1925.

Six years of commodity shipments in the Northwest, analyzed for norms and explanation of variations from normal. Published April 30, 1925.

Analysis of sales of investment securities in the Northwest since 1920. Published May 29, 1925.

#### Group IV. Studies in Progress.

(1) Sugar beets as a diversification crop for the Northwest, being a survey of the market for sugar, domestic production, agricultural problem of producing beets, etc.

(2) Determination of the normal rate of growth for cities with particular reference to the building activity of Minneapolis and St. Paul.

JAY L. O'HARA, B.A., Lecturer in Economics.

1. A Uniform System of Accounts for the Minnesota State Association of Funeral Directors. The following summary was published: Minnesota System of Accounting. *Embalmers' Monthly*, 37:62-67. 1924.

The purposes of this work were: (1) to secure information relating to the best commercial and accounting methods and devices employed by practitioners throughout the United States; (2) to adapt and mold these into a unified whole; (3) to develop such forms and methods as were necessary to insure completeness and simplicity to the system.

The leading practitioners of the country were requested to submit statements of their methods and systems together with specimens of the forms used for record purposes in their establishments, as a basis for ascertaining present practice. From the information thus secured, composite record forms were constructed, with the addition of such forms and parts as seemed desirable. The completed work was adopted as standard practice by the State Association. The system evolved is used as a part of the course in Business Methods by the Extension Division of the University of Minnesota.

#### 2. Economic Effects of Product Simplification.

The purpose of this study is the accumulation of information relative to the economic effects of the program of simplification inaugurated by the War Industries Board and carried out, since 1920, by the Fabricated Production Department of the U. S. Chamber of Commerce and the Division of Simplified Practice, Department of Commerce. This involves the digesting of some 250 articles which have appeared in magazines, trade journals and government reports since 1921, and the securing of additional information and verification through correspondence with trade associations and individual manufacturers. The results of this investigation should furnish an objective measurement of the waste entailed in one aspect of the competitive system, namely the multiplication of unnecessary variety in production.

RALPH H. FARMER, B.A., Instructor in Economics.

Taxation of Banks in the United States. (To be offered as a thesis for the Ph.D. degree; R. G. Blakey, Adviser.)

The existing situation as to bank taxation is being examined in the light of the principles of public and private finance. Attention will also be given to the constitutional aspects of the problem.

RICHARD A. GRAVES, M.A., Instructor in Economics.

The Departments in the American Federation of Labor. A Study in Industrial Unionism. (To be offered as a thesis for the Ph.D. degree; under the direction of A. H. Hansen.)

The work is divided into four parts, including (1) the metal trades; (2) the building trades; (3) the railway employees; (4) mining.

The source materials include the *Department Convention Proceedings*; the *Proceedings of the American Federation of Labor*; trade journals and other publications.

CALVIN B. HOOVER, B.A., Instructor in Economics.

Capital and Contract in Genoa in the Twelfth Century. (Thesis for the Ph.D. degree in the University of Wisconsin.)

The principal primary sources which have been used are the unedited records of contracts of the twelfth century, which were compiled by the public notaries. These records are in medieval Latin, and the original copies are in the archives of Genoa. Photostatic copies of the records for a period of over one hundred years are in file in the library of the University of Wisconsin. In addition to these unedited records, the acts of the notary Giovanni Scriba, covering a period of about ten years, are available in the *Monumenta Historiae Patriae*. In the same series the *Leges Genuenses* and the *Liber Iurium Reipublicae Genuensis* have been used. The development of contractual forms of a capitalistic nature have been traced during a period of about sixty years, and their relationship to capital accumulation noted.

The principal contractual instruments used in the combination of individual capitals into a larger unit were the sea loan, the *societas*, and the *accomendatio*. These contractual instruments were gradually modified in order to meet the needs of an expanding commerce, and to evade the ecclesiastical opposition to usury in particular and capitalism in general.

DUANE McCracken, M.A., Instructor in Economics.

Labor and the Courts. (Thesis for the Ph.D. degree; under the direction of A. H. Hansen.)

The chapter headings and contents are as follows: I. Introduction: Sources of the Conflict. A brief survey of court decisions which have caused vigorous protest from the labor groups. II. Protection of Women and Children. An analysis of leading cases dealing with this subject. III. Regulation of Hours of Labor. An analysis of leading cases involving regulation of hours. IV. Regulation of Wages. An analysis of leading cases involving regulation of wages. V. The Courts and Trade Unionism. An examination and analysis of leading cases involving labor organizations. VI. The Writ of Injunctions. A discussion of the evolution of the Writ of Injunction with special emphasis upon its use in labor cases. VII. Social Evolution vs. Legal Evolution. A critical examination of the view that our legal institutions have failed to keep pace with the evolution of economic society. VIII. Proposals for Curbing the Power of the Courts. An examination and appraisal of these proposals. IX. Summary and Conclusions.

HAROLD S. ROCK, M.A., Instructor in the School of Business.

The Accrual of Expense and Revenue under Income Tax Regulations. (Thesis for the M.A. degree; E. A. Heilman, Adviser.)

The study is made to discover the criteria by which the government assigns net revenue to definite periods for the purpose of the income tax and to discover the degree of conformity of these principles to those of economic theory and to recognized accounting practice of accruals. Analysis of accrual under *Regulations 62* and in cumulative bulletins shows that the government's deviations from the principles of economic theory are so numerous and contradictory as to fail to disclose a distinct

set of criteria. Divergence from the basic economic principles which, it is hoped, will ultimately guide the government, is due, for the most part, to the difficulties of securing an equitable administration without unreasonable expense. The remaining unnecessary or illogical variations are noted and criticized.

WILLIAM H. STEAD, M.A., Instructor in Economics.

The Place of Education and Training in the Personnel Program. (Thesis for the Ph.D. degree; under the direction of A. H. Hansen.)

The chapters and contents are as follows: I. Introduction. Statement of general thesis, problems raised, and source of materials used. II. Value of Education to the Worker. Selection for promotion. General thesis that education is the basis for advancement, that adequate opportunities exist, that education will have balancing up effect. III. Value of Education to the Employer. Interest and efficiency. Psychological background, and data as to effect of training and education on productive efficiency. IV. The Training of Foremen. Accepted practices, and guiding principles of training for foremanship. V. Training of Executives by Outside Agencies. Analysis of co-operative university courses, university business and engineering training, etc., as background for executives. VI. Training Executives in the Plant. Analysis of various plans for training executives in the plant. VII. The Selection of Workers for Training. The criteria of selection, workability of various tests, etc. VIII. The Use of Outside Educational Facilities for the Worker. Public, private, philanthropic, and co-operative schools and courses and their potential contributions to the problem. IX. Training the Worker under Plant Supervision. Critical review of the various training plans in common use. X. Conclusions and Practical Suggestions. Attempts at answering the main problems raised, and suggested programs of training.

All the above material together with a section on the general education of the worker, is to be included in a volume under the same title, to be used by Dr. H. C. Metcalf, director of the National Bureau of Personnel Research, as a possible future volume in his *Human Relations Series*, published by the Williams and Wilkins Company of Baltimore.

W. BAYARD TAYLOR, M.A., Instructor in Economics.

Labor Banks. (Thesis for the Ph.D. degree; A. H. Hansen, Adviser.)

The chapter topics are as follows: I. The Modern Labor Bank. Description as to organizations, and technique of the institutions. II. Causes and Aims. Why formed, and what they hope to do. III. The Depositors. Who they are; who they should be, in the light of banking policy. Relation to remedial institutions. IV. Their Loan Policy. Are they wise bankers? Can they be? Who are their borrowers? V. Labor Banking and Trade Unionism. A reversal of the latter, or new weapon? VI. In the Light of History. A depression movement? Co-operative in character? Inflationist? VII. Conclusions. What of the future? Their place in the financial fabric.

Material: Labor periodicals, trade union proceedings; labor bank statements; questionnaires to labor banks, trade union leaders; current periodicals, newspaper clippings; secondary treatises on trade unionism and private finance.

ARTHUR BORAK, M.A., Assistant in the School of Business.

The Financial History of the Pan Motor Company. (Thesis for the M.A. degree; under the direction of J. W. Stehman.)

The information was secured through the close study of the court records of the trial and appeals of Mr. Samuel Pandolfo, the promoter, correspondence, statements, pamphlets, and published articles some of which are in the files of certain formerly interested parties like the company's former attorneys and the members of the Minnesota State Securities Commission.



Contrary to generally prevailing public opinion, Mr. Pandolfo acted in good faith in his efforts, and, it seems, really acted to the best of his ability against obstacles arising out of the war to make the company a success. However, the company was promoted at a very undesirable time—during a period of abnormal demand by the so-called essential industries for our relatively limited resources to carry on the war. If the promotion had come at a more normal period it would have been most likely completed and put on an operating basis, but nowhere near the scale dreamed of by the promoter. Being a promoter with an over-ambitious program constantly in mind, a crisis no doubt would have resulted in his finally losing control of the enterprise to more conservative enterprise with some loss to the stockholders. The whole undertaking seems to bring out the advisability of government interference and regulation of promotions through capable commissions for the protection of the large number of uninformed people who are brought into these undertakings.

JAMES M. MAHONEY, B.S., Graduate Student.

Factors Entering into the Demand for Moderate Priced Automobiles.  
(Thesis for the M.A. degree; under the direction of F. B. Garver.)

The common explanation advanced for the enormous sale of automobiles has been increased income. However, certain statistical evidence has been advanced which disproves this contention. The purpose of this thesis is, therefore, to discover the fundamental and satisfactory explanations for these increased expenditures.

The conclusions drawn from this study may be stated briefly. Although incomes afford only a partial explanation for the increase in automobile sales, important evidence has been disclosed which shows that real incomes have increased more than indicated by the best income data available. There has been an important decline in expenditures for certain items of consumption making possible the diversion of part of this money to the purchase of cars. These factors, together with the intensive selling methods practiced in the trade, constitute the fundamental explanations for the enormous increase in automobile sales.

CARL J. RATZLAFF, M.A., Graduate Student.

A Functional Study of Marketing Middlemen Who Sell to the Retail Grocery Trade with Special Reference to the Twin Cities. (Thesis for the M.A. degree; R. S. Vaile, Adviser.)

The functional approach to a study of this kind enables one to divide a large problem into constituent problems. The marketing functions performed by middlemen are: (1) the functions of exchange, which include those of assembling and selling; (2) the functions of physical supply, which include those of storing and transporting; (3) the auxiliary or facilitating functions, which include those of risk assumption, financing, and standardization.

The middlemen who serve retailers of staple food products are: (1) wholesalers or jobbers; (2) brokers; (3) manufacturers and manufacturers' branch houses; (4) retailers' co-operative associations. The grocery wholesalers perform primarily a selling, storing, and financing function. The brokers' specialization is one of function and also of commodity. The manufacturers and manufacturers' branch houses perform all marketing functions to a greater or less degree but are primarily interested in performing a specialized selling and storage service, the nature of which is such that local jobbers are unable to perform these functions effectively. The origin of retailers' co-operative groups is largely due to their desire to perform for themselves the functions of assembling and selling. Co-operative assembling or buying secures for the members quantity discounts and co-operative selling enables the members to employ the same selling practices as chain organizations.

## THE MEDICAL SCHOOL

### ANATOMY

CLARENCE M. JACKSON, M.S., M.D., LL.D., Professor of Anatomy and Director of the Department of Anatomy.

1. The Effects of Inanition and Malnutrition upon Growth and Structure. Philadelphia: P. Blakiston's Son and Company. 1925. 616 pages.

This book presents a systematic review of the subject, with a bibliography of about 2,800 titles. The work is comprehensive in scope, including the effects of inanition in both plants and animals. Both total inanition (ordinary starvation) and partial inanition are considered. The latter term includes deficiencies in various essential dietary factors, such as proteins, salts, vitamins, and water. In addition to a summary of the investigations already published by the author and his co-workers in this field, it includes a large amount of original data, especially graphs and tables showing the effects of inanition upon various organs in malnourished children.

2. Spontaneous Nephritis and Compensatory Renal Hypertrophy in Albino Rats on Diet Deficient in Vitamin A. *Proceedings of the Society for Experimental Biology and Medicine*, 22:410-13. 1925. Also (abstract) in *Anatomical Record*, 29:363. 1925.

An epidemic of chronic nephritis of a peculiar type was found in a colony of albino rats. The gross and histological changes are described. A possible factor in causing the nephritis was the diet, which was somewhat deficient in proteins and vitamin A. When one of the nephritic kidneys was removed, a progressive hypertrophy of the remaining kidney occurred (as in normal rats), but the increase was due mainly to dilation of the renal tubules.

THOMAS G. LEE, B.S., M.D., Professor of Comparative Anatomy.

A Further Investigation of the Implantation of the Ovum, the Trophoblast, the Formation of the Placenta, and the Early Stages of Development in Mammals, Previously Undescribed.

This work is in progress.

ANDREW T. RASMUSSEN, Ph.D., Professor of Neurology.

1. Quantitative Studies on the Normal Adult Male Hypophysis. (a) A Quantitative Study of the Human Hypophysis Cerebri or Pituitary Body. *Endocrinology*, 8:509-24. 1924. (b) The Relative Number of the Different Types of Cells in Pars Anterior of the Normal Adult Male Hypophysis of Man. *Proceedings of the American Association of Anatomists. Anatomical Record*, 29:394. 1925.

An attempt to establish norms for the weight of the entire organ and of its various lobes, the amount of colloid, the relative number of the various types of cells in pars anterior, and the cytology of the chief cellular elements as standards for the evaluation of experimental and pathological work, there being no accurate data on most of these points. Serial sections are mounted and stained. The total number of cells counted in each case varies from 10,000 to 30,000.

Results to date may be summarized as follows: (1) The weight of 50 selected normal male adult hypophysis from 19 to 65 years of age varied from 0.400 to 0.855 grams—average 0.560 grams. (2) Weight is maximal between ages of 35 and 45 years. (3) Weight is correlated with stature. With stature 159-173 cm., hypophysis

averages 0.537 grams. With stature 173-192 cm., hypophysis averages 0.652 grams. (4) There is no correlation between body weight and hypophyseal weight in the adult male. (5) There may be wide variations between the relative size of the sella turcica and the size of the hypophysis. (6) Pars anterior (volume of lobes determined in 30 normal males) varies from 46 to 87 per cent, average 72 per cent of entire gland. (7) Pars nervosa varies from 7 to 30 per cent, average 18 per cent. (8) Pars intermedia varies from 0.35 to 10 per cent, average 2 per cent. About one half of this is colloid. (9) Capsule varies from 2 to 20 per cent, average 8 per cent. (10) Above data on three cases with external physical signs of non-neoplastic post-adolescent hypopituitarism not only showed them to be within normal limits but very close to the normal averages. (11) Differential count of types of cells (38 normal males) shows that the chromophobes vary from 37 to 65 per cent, average 58 per cent. (12) Acidophiles vary from 23 to 43 per cent, average 30 per cent. (13) Basophiles vary from 5 to 27 per cent, average 12 per cent. (14) Variability in relative number of the three types of cells seems to decrease after 45 or 50 years of age. (15) Chromophiles apparently decrease noticeably after 50 years.

## 2. The Fiber Tracts in the Brain Stem of the Cat.

The purpose of this work is to get actual degeneration specimens by the Marchi method of all the principal fiber tracts with the view of getting demonstration material for regular class work and advanced studies in neurology to be published later as a monograph. In the cat nearly all the important bundles are arranged as in the human brain thus affording easily available laboratory material which can be used to elucidate human neuro-anatomy. There are still many disputed points about certain tracts which a large number of especially placed lesions should clear up. Forty series are now on hand (most of these being the results of work before 1924), which are being studied and used for demonstration. Several more are in progress.

3. See also the studies by W. P. Covell, J. W. Kernohan, and E. K. Rowles.

RICHARD E. SCAMMON, Ph.D., Professor of Anatomy.

1. A Summary of the Origin and Classification of Human Double Monsters, and Related Forms of Embryonic Duplication, with Particular Reference to Their Frequency, Variability, Growth, and Surgical Separation. Published in *Pediatrics by Various Authors* (I. Abt, editor), 6:654-82.

2. (With L. A. Calkins.) The Relation between Body Weight and Age in Prenatal Life. *Proceedings of the Society for Experimental Biology and Medicine*, 22:157-61. 1924.

A study of the relation between the body weight and the age of the human fetus with particular reference to the expression of this relation by empirical formulae. The study was based upon approximately 7,000 observations on fetuses, premature infants, and full-term newborn children. Numerical expressions for this relation have been developed on the basis of previously determined formulae for the relation of stature to body weight and stature to body length. Curves and formulae for the relationships of the three variables, stature, weight, and age are included.

3. (With L. A. Calkins.) The Proportionate Growth of the External Dimensions of the Human Body in the Fetal Period. Preliminary publication in the *Proceedings of the Society for Experimental Biology and Medicine*, 22:353-57. 1925. Final publication is in press as a monograph in the *Research Publications of the University of Minnesota, Biological Series*.

A study of the growth of some 70 external dimensions of the body as determined by the measurement of about 350 fetuses ranging in age from the third month of

gestation to birth. The investigation includes an extensive study of experimental error in this type of observation, the development of empirical formulae for the growth of various parts of the body and a colligation of all previously published data on this subject.

4. (With L. A. Calkins.) The Relation between Crown-Heel and Crown-Rump Length in the Fetal Period and at Birth. *Anatomical Record*, 29:372-73. 1925.

Both the crown-heel and crown-rump length have been used extensively as standard measurements for fetal and newborn material, but there seems to be no detailed study of their relative accuracy. Experimental studies of the effects of simple preservation and of injection with subsequent preservation indicate that the average relative error produced by these factors is about the same for both measurements.

Experimental and statistical studies were made of the error of actual measurement of preserved, fresh dead, and living material. The error of measurement of living individuals is the greatest, that of fresh specimens is next, and that of preserved material is the least. Large series of measurements of single specimens indicate that several factors influence the determination of length and that these errors do not show a strictly symmetrical distribution. The error in the determination of crown-heel length of all three classes of material seems somewhat less, relatively, than that of the crown-rump length.

A critical study was made of the various published interpolation formulae for these measurements. These published formulae were compared with other empirical expressions developed by graphic methods, by the method of means, and by least squares. Our study indicates that all these formulae are of a simple linear type and that the results of most of them lie well within the limits of experimental error.

5. (With E. L. Armstrong.) The Growth of the Human Eyeball and Optic Nerve. *Journal of Comparative Neurology*, 38:165-219. 1925.

A quantitative study of the growth of the human optic apparatus in fetal life and in postnatal life to maturity. The chief conclusions are as follows:

The growth in volume of the eyeball in the fetal period (three lunar months to birth) follows the general course characteristic of the weight or volume of the body as a whole and of all the organs and parts which have been quantitatively studied to the present time. More specifically, the growth is very similar to that of the spinal cord and brain stem. The eyeball a little more than doubles its weight between birth and maturity. Most of this growth is made in the first five years of postnatal life. No definite evidence was found of a puberal increase in eyeball weight in man. The general character of the postnatal growth in mass of the optic apparatus is similar to that of the brain and related structures. The amount of postnatal growth is much less, both absolutely and relatively (with respect to newborn values).

It is estimated that the coats of the eye form the greatest part of the postnatal growth; the contents of the bulbus, including the lens, come next; and the cornea makes the least postnatal increase.

6. (With C. K. Petter.) The Physical Development of Suspected Tuberculous School Children.

A study has been made of the interrelations of body weight, stature, and age in a group of tuberculous and suspected tuberculous school children examined in the Out-Patient Department of Lymanhurst School and Hospital. A total of some 2,500 individuals was studied. The sexes were approximately equally distributed in this group. Three hundred of the children were later admitted to the in-patient service with a diagnosis of tuberculosis or with sufficient symptoms to warrant further observation.

The records of these children were studied by comparison with the usually accepted norms for age and weight, age and stature, and age, weight, and stature, by means of numerical computation and graphic analysis. In general, it was found that



this population was equal to, or slightly above, the usual quoted norms of stature for age and only moderately below these norms of weight for age, but it was distinctly below the norms of weight for stature. It is probable that the relatively large stature for age, noted in this group, is characteristic of the general population from which it is drawn. This observation emphasizes the need of establishing local standards of the physical development of children, particularly in those districts which have a distinctive racial make-up.

7. (With H. L. Dunn.) The Postnatal Growth of the Human Central Nervous System. *Proceedings of the Society for Experimental Biology and Medicine*, 22:353-57; *Anatomical Record*, 25:149.

This investigation involves the analysis of some 3,000 records of the weight of the brain and its parts and the spinal cord between birth and maturity. The growth of the structures has been studied in relation to age, sex, and stature, and empirical formulae have been developed for the expression of the results. A special investigation has been made of the change from the fetal to the postnatal type of growth curve of the nervous system which takes place in the first year.

8. See also the studies by W. T. Peyton, L. F. Richdorf, R. B. Allen, E. J. Borgeson, A. J. Herbolzheimer, C. H. Osborne, H. E. Roe, J. H. Schaeffer, G. H. Scott, and C. H. Watkins; also those with F. L. Adair, C. E. Proshek, and R. E. Swanson (Department of Obstetrics and Gynecology), and O. H. Wangenstein (Department of Surgery).

CHESTER A. STEWART, M.D., Ph.D., Assistant Professor of Pediatrics.

1. (With C. H. Watkins.) Growth of the Internal Organs of Anencephalic Fetuses.

A quantitative study was made of the growth in mass and volume of the various internal organs of human anencephalic fetuses. Nineteen specimens were examined. The data were analyzed by graphic and numerical methods. While the growth of the various viscera in anencephalic fetuses is quite irregular, the general course is, on the whole, similar to that of normal specimens. The eyeballs, the thymus, and the ovaries show more growth than in the normal, while the suprarenals, spleen, spinal cord, optic nerve, stomach, pancreas, lungs, kidneys, and liver show less growth than in the normal. Total body weight, heart weight, and trunk weight approximated their normal growth.

2. See two other studies listed under Department of Pediatrics.

HYMAN S. LIPPMAN, M.D., Ph.D. in Pediatrics, Instructor in Pediatrics.

1. A Morphological and Clinical Study of Bone Marrow.

By means of bone marrow smears made by spreading a suspension of the marrow in sodium citrate and blood serum, we have a method of observation comparable to that used in studying blood. The material collected to date is as follows:

*Human marrow.*—Five adults—killed in accidents. This offers normal adult marrow to be used as a standard. Twenty adults—death due to various diseases. This will be compared with the normal human. Twenty children of various ages who have died of acute infections. Twenty newborns obtained from the Department of Pathology. Many of these have died of birth trauma, so that the marrow has not been altered due to pathology, and the picture is that of normal marrow at birth. More human material will be added.

*Animal marrow.*—Several guinea pigs, pigeons, rabbits, dogs, and cats will be studied. A group of thirty pig embryos of various ages is also included in this study. The effect of hemorrhage and infection on bone marrow will be studied on the laboratory animals.

2. Masked Juvenile Tuberculosis. (See under Department of Pediatrics.)

3. Bronchiectasis in Children. (See under Department of Pediatrics.)

SHIRLEY P. MILLER, Ph.D., Instructor in Anatomy.

1. Experimental Studies on the Effect of Underfeeding from Birth upon the Liver of the Albino Rat.

A study was made of weight changes in the liver of eighty rats compared with the weights of the liver in normal animals of the same body weight. Cytological changes in the liver cells were compared with those in normal rats. A decrease was found in the size and number of mitochondria, in the cytoplasmic vacuoles, and in granules of glycogen. An increase in fat droplets occurred. A statistical study was made of the changes in the diameters of liver cells during underfeeding. The diameters of 2,000 cells have been measured. These show a definite decrease in cell diameter, according to amount of injury to the organ. The measurements are being continued over a larger number of specimens.

2. (With G. H. Scott.) Individuality of Mitochondria.

The attempt is being made to confirm the experimental work of Wallin, Portier, and others upon the individuality of mitochondria. Tissue cultures of liver cells from rabbit and guinea pig are being studied by means of sub-vital stains. The cultivation of mitochondria from these liver cells upon artificial media is being attempted. One hundred fifty tissue cultures and three hundred tube explants have yielded negative results. Work is being continued.

3. Morphological and Histological Studies upon the Digestive Systems of the *Chaetonodontidae* and *Achanturidae* from the Island of Oahu.

Detailed dissections of ten species belonging to these families show a number of hitherto undescribed anatomical features not characteristic of the typical teleostean digestive system. These features are length of the intestine, arrangement of the pyloric ceca, and the biliary system. Histological study is being made of the stomach, intestine, and liver from these forms.

WILLIAM T. PEYTON, M.A., M.D., Instructor in Anatomy.

1. The Developmental Topography of the Brain and Cranial Nerves As Determined by Orthoscopic Plottings to Constant Areas. (Part of a thesis for the Ph.D. degree; R. E. Scammon, Adviser.)

The head and neck were dissected and drawn by the orthoscopic method and the resulting plottings reduced to the same surface area. The figures obtained by this procedure show relative rates of growth in various structures and areas not readily demonstrated by other methods. One fetus, four newborn infants, a child of the eighth postnatal month, and one adult were studied by this method.

The fissure of Rolando moves backward with growth. The lateral sulcus is more constant in position. The inferior surface of the temporal lobe is also quite constant in position. The lateral ventricle undergoes no appreciable change in position or relative size when compared with the growth of the lateral area of the head and neck. Changes in position of the cranial nerves are due almost entirely to growth of the facial part of the skull.

2. The Developmental Topography of the Head and Neck As Determined by the Orthoscopic Method. (Part of a thesis for the Ph.D. degree; R. E. Scammon, Adviser.)

The purpose is to follow changes which occur in anatomical relations during the growth period and to determine the relative rates of growth in various regions

and structures. Adult, infantile, newborn, and fetal specimens were used in the study.

There is relatively little growth in all the bones of the cranial vault during the period covered by this material. Growth in the parietal bone is greater anteriorly than it is posteriorly. The sella turcica lies higher in relation to the squamous suture at maturity than at birth. The zygomatic arch, when compared with the base of the skull, shifts downward with growth. The orbit, and with it the eye, shifts downward and forward with growth. The region of greatest growth is in the maxilla. The middle ear and tympanic membrane are relatively large at birth and they shift upward and backward with growth. The descent of the larynx and trachea is about equal to the vertical growth of the maxilla. The lacrimal gland grows at about the same rate as the orbit but the salivary glands grow more rapidly and descend with the growth of the maxilla. The temporal muscle covers a greater area of the parietal bone at maturity than it does in the fetus and newborn.

LAWRENCE F. RICHDORF, Ph.D., M.D., Instructor in Pediatrics.

1. The Physical Growth of the Infant in the First Year. (Thesis for the degree of Ph.D. in Pediatrics; under the direction of R. E. Scammon.)

A quantitative study was made of dimensional and ponderal growth of Minnesota infants in the first year of postnatal life. The weight and forty-six external dimensions of the body were determined. Twenty-five selected infants of each sex were measured in each month. The resulting data were analyzed by graphic and numerical methods. Some of the main results obtained may be summarized as follows:

Males grow more rapidly than females in the first and fourth quarters of the year. At the end of the year males exceed the females in body weight, head circumference, sitting and standing height, and length of the upper extremity. Females exceed males in intercrystal diameter, calf circumference, and length of the lower extremities.

Dimensions associated with skeletal growth show less variability than those associated with the growth of the soft tissues. Growth in head circumference was found to be less variable than that of other dimensions. The sitting height exceeds the chest circumference and the length of the lower extremity exceeds that of the upper extremity after the first trimester. As a rule the chest circumference exceeds the head circumference after the third trimester. In general, individuals of high birth weights show the greatest growth in the first year.

2. See other studies listed under the Department of Pediatrics.

R. BERNARD ALLEN, B.A., M.A., Teaching Fellow in Anatomy.

1. Quantitative Studies on the Growth of the Human Kidney. (Thesis for the M.A. degree; under the direction of R. E. Scammon.)

The purpose of this study is to determine the absolute and relative growths of the renal medulla and cortex through fetal and postnatal life, preliminary to a quantitative analysis of the growth of the renal tubule. A series of twenty-six human kidneys of various ages was examined. The determinations of the volumes of medulla, cortex, and entire kidney were made by the application of a graphic reconstruction technique on serial cross sections.

*Principal results.*—(1) Renal growths in volume and in weight, within narrow limits, are relatively the same. (2) Renal medullary growth in volume is rapid in the fetus, increasing fourfold in the last four fetal months. Postnatal growth is less rapid; the volume at two and one-half years represents a twofold increase over natal volume. (3) The renal cortex, like the medulla, increases fourfold in the last four fetal months. Growth is very rapid during infancy and early childhood, there being a fivefold increase by two and one-half years. (4) The relation of medulla to cortex averages 1:1.4 in the fetus and is fairly constant. At or soon after the close

of infancy the adult relation of 1:2.5, is established. (5) The renal medulla and cortex vary directly with body weight in the fetal period. In the adult there is far less medulla and somewhat less cortex per unit of body weight than at any other period.

## 2. Topographical Relations of Medulla and Cortex of the Human Kidney.

The purpose of this investigation was to determine the changes in the intrinsic topography of the human kidney during growth. A series of twenty-six kidneys was examined. The method consisted of an analysis of drawings of serial cross sections of all specimens. The results are not yet fully colligated but certain changes are evident. The definite bilateral symmetry of medullary structures, which is present during fetal life and early childhood, is partially, if not wholly, lost by maturity.

EGBERT J. BORGESON, B.S., M.D., Fellow in Ophthalmology and Otolaryngology.

A Study of the Developmental Topography of the Orbital Region in Fetal Life and in the Newborn. (Thesis for the M.S. degree; under the direction of R. E. Scammon.)

The study is being carried out by the application of Kastschenko's method of reconstruction to the earlier specimens and the orthoscopic method to older material. The investigation is under way but is not sufficiently advanced to warrant a report of conclusions.

WALTER P. COVELL, M.S., Teaching Fellow in Anatomy.

1. A Volumetric Study of the Hypophysis in Fetuses and Newborn Infants. (Thesis for the Ph.D. degree; A. T. Rasmussen, Adviser.)

Determination of the rate of growth of the hypophysis during prenatal life. The transverse and vertical diameters increase approximately threefold between the third fetal month and birth. The antero-posterior diameter increases 6.5 fold. From the fourth fetal month to birth the weight of the hypophysis increases nearly sixfold. Pars anterior composes 80 to 90 per cent of the gland up until the third fetal month. It then decreases relatively and at birth forms 65 to 75 per cent of the hypophysis. Pars intermedia is 3 to 4 per cent of the gland volume up to the third fetal month and likewise decreases relatively until at birth it forms 1.5 to 2.5 per cent of the gland. The pars nervosa is approximately 10 to 12 per cent of the gland volume up until the sixth fetal month and from 20 to 25 per cent in the hypophysis of a newborn. During the latter half of the fetal period chromophobes represent 60 to 70 per cent, eosinophiles 20 to 30 per cent, and basophiles 6 to 8 per cent.

2. The Hypophysis of Anencephalic Fetuses. *Proceedings of the American Association of Anatomists. Anatomical Record*, 29:353-54. 1925.

The condition of the hypophysis in this anomaly is of importance as a factor in determining at what stage the brain defect occurred and also to what extent the nervous lobe influences the glandular portion derived from the mouth. A hypophysis was present in all of the thirty-two anencephalic fetuses (fifth month to full term) examined. The glandular portion consists of two lateral and one central mass. Pars nervosa was present in 20 per cent of the cases. Pars intermedia may be present without the pars nervosa. An infundibulum was lacking in all instances. The total weight of the hypophysis was generally below normal. The anterior lobe is overweight, due to dilatation of sinuses with blood and to increased amount of trabeculae. Pars intermedia is about normal in amount when visible. Pars nervosa is never present in full amount. Pars anterior represents 92 to 98 per cent of the total weight as compared to 73 to 84 per cent for the normal hypophysis. The trabeculae are 1 to 4 per cent as compared with 0.8 per cent for the normal. Pars intermedia is about



3 per cent of the total weight. Pars nervosa when present is 1.5 to 5 per cent of the total weight as compared with 14 to 24 per cent for the normal fetal hypophysis.

### 3. Variations and Correlations on the Diameters of the Heads of Newborn Infants. (See under Department of Botany.)

ALBERT J. HERBOLSHEIMER, B.S., M.D., Teaching Fellow in Ophthalmology and Oto-Laryngology.

A Study of the Developmental and Adult Topography of the Temporal Bone. (Thesis for the degree of Ph.D. in Ophthalmology; under the direction of R. E. Scammon.)

The topography of the human temporal bone has been studied in the infant and adult. For this purpose a special orthoscopic instrument has been devised which permits the rapid plotting of the outlines of superimposed structures with great accuracy. The results of the study are not sufficiently complete to warrant a detailed report at this time. The orthographic instrument has been briefly described in the *Anatomical Record*, 29:401. 1925.

JAMES W. KERNOHAN, M.A., M.B., B.Ch., D.P.H., Mayo Foundation Fellow.

The Ventriculus Terminalis: Its Growth and Development. *Journal of Comparative Neurology*, 38:107-25. 1924. (Thesis for the M.A. degree; A. T. Rasmussen, Adviser.)

The purpose of this study was to ascertain the true status of this cavity which has become of considerable interest since spinal anesthesia was introduced. Eighteen human fetuses, 5 newborns, 3 children, and 4 adults furnished the material. Serial sections were studied and three models made.

The data tend to show that this is a true ventricle, analogous to the brain ventricles. Curves of growth of the various diameters and its volume show an increase in a regular manner throughout fetal life. No communication exists between the ventriculus and the subarachnoid space. Models of the cavity show it to have an irregular outline, ending blindly below in the filum terminale and communicating above with the central canal of the spinal cord. It is present in all cords examined and first appears in 22 mm. crown-rump fetuses. Mitotic figures are found in its walls until birth, and cilia are present on the ependymal cells during fetal life and the first few years of postnatal life. Fixation of the tissues seems to increase the irregularities of the walls. During life it is probably an ovoid sac. Injections of dye into the ventriculus rupture its walls, while postmortem changes rapidly digest away the ependyma, leaving an artificial communication between this cavity and the subarachnoid space.

CARVER H. OSBORNE, B.S., M.D., Teaching Fellow in Anatomy.

A Study of the Minor Peritoneal Folds and Fossae of the Human Abdomen. (Thesis for the M.S. degree; R. E. Scammon, Adviser.)

This research involved the study of the minor folds and fossae in a series of 180 cadavers of various ages, together with a systematic colligation of the literature on these structures including their genesis, classification, synonymy, frequency, and the abnormalities produced by them. The conclusions may be summarized as follows:

The minor peritoneal folds and fossae are normal anatomical structures and are not to be confused with bands and membranes of an inflammatory origin. That they are congenital in origin is shown by their early appearance in the fetus. They may be grouped according to the frequency of occurrence during certain periods of life as follows: (1) Those occurring particularly in fetuses and newborn infants but which

disappear shortly after this time: the ileocolic fossa, venous recess, fossa of the splenic flexure, genitomesenteric folds. (2) Those increasing in frequency after birth: (a) Immediately after birth: cystico-duodeno-epiploic fold, intersigmoid fossa. (b) During adult life: ascending mesocolon, descending mesocolon. (3) Those which occur in practically the same percentage throughout fetal and postnatal life: parieto-colic fold, retro-colic fossa, ileo-parietal fold, superior duodenal fold and fossa, inferior duodenal fold and fossa, duodeno-jejunal fossa, inter-mesocolic fossa, retro-duodenal fossa. (4) Those which are constant: superior ileo-cecal fold and fossa, ileo-ceco-appendicular fold and fossa.

The folds and fossae may also be arranged in groups depending upon the manner of their development.

HAROLD E. ROE, B.A., Teaching Fellow in Anatomy.

The Growth of the Musculature in the Human Fetus. (Thesis for the M.A. degree; R. E. Scammon, Adviser.)

A study of the growth of the total skeletal musculature and the skeleton as compared with body growth, and also the relative rate of growth of the different parts of the musculature in the fetal period. Both fresh and preserved specimens have been used in the study. The method of examination was as follows: all of the muscles of each body were dissected and removed from the skeleton, and then weighed as thirty separate groups. The wet and dry weights of the skeleton and its parts have been determined. Results and conclusions have not been fully determined, but from the work completed it appears that the course of the growth of the musculature is very much the same as that of the skeleton and that both can be regarded as first functions of the total body weight.

EVERETT K. ROWLES, B.A., M.A., Assistant in Anatomy.

Quantitative Study of the Hypophysis Cerebri of the Guinea Pig in Experimental Scurvy. *Anatomical Record*, 29:394. 1925. (Thesis for the M.A. degree; A. T. Rasmussen, Adviser.)

The purpose of this investigation was to determine in what respects the apparently enlarged hypophysis in experimental scurvy differs from that of normal animals. The results are based on eight controls and thirteen scorbutic animals.

A scorbutic diet produces apparently no marked effect on the absolute weight of the whole hypophysis in the guinea pig. The gross weight of the hypophysis continues to increase as during normal growth. Ten days after beginning of scurvy symptoms, the pars anterior shows a slightly larger percentage of the whole hypophysis, and the pars intermedia and pars posterior show a corresponding smaller percentage. In the final stage of scurvy, however, there is a decided increase in percentage weight of pars anterior, and a corresponding decrease in percentage weight of pars intermedia and posterior. There is a 50 per cent increase in the volume of blood in the hypophysis ten days after beginning of scurvy symptoms, and a 376 per cent increase in the final stage. The apparently normal growth in the hypophysis during scurvy is due, therefore, to congestion in the pars anterior and not to growth in the essential parenchyma. There is an actual decrease in parenchyma.

GORDON H. SCOTT, B.A., M.A., Teaching Fellow in Anatomy.

1. Growth of the Crypts and Glands of the Human Stomach. Abstract in the *Anatomical Record*, 29:395-96. 1925. Paper in press in the *American Journal of Diseases of Children*. (Part of a thesis for the Ph.D. degree; R. E. Scammon, Adviser.)

The growth changes in the number of gastric crypts and glands per square millimeter of mucosa are followed from the ninth fetal month to maturity. Thirty-four stomachs have been examined in this series; especial attention has been paid to newborn and postnatal stages. An analysis of the data collected shows an increase

in the number of gastric crypts per square millimeter from the ninth fetal month until the third year. After this time the number is constant. The number of gastric glands per unit area increases markedly until the third year and remains constant until sometime between the seventh and fifteenth years. By the fifteenth year they have been reduced approximately one third of their number.

2. Growth Changes in the Dimensions of the Crypts and Glands of the Human Stomach. (Part of a thesis for the Ph.D. degree; R. E. Scammon, Adviser.)

The dimensional growth changes in the gastric crypts and glands are being followed from the sixth fetal month to maturity. Eighty stomachs are being studied in this series, twenty-three fetal, twenty-three newborn, and the remainder distributed evenly between birth and forty-four years. Three hundred fifty measurements are being taken of various dimensions of the crypts and glands at different ages. An attempt is being made to calculate the changes in gland volume concomitant with the changes in number of these structures per unit area of gastric mucosa. A study of the changes in finer histologic structure is being undertaken.

3. An Experimental Study of the Effects of Distention on the Gastric Mucosa. (Part of a thesis for the Ph.D. degree; R. E. Scammon, Adviser.)

Fresh stomachs of the rat, dog, and newborn human stomachs secured at necropsies have been distended with fixing fluid under high pressures. Counts of the number of gastric crypts and glands per square millimeter are being made in an effort to determine the degree to which distention affects these structures. From the data at hand it appears that pressures of over sixty millimeters of mercury are required to produce a true stretching of the mucosa and thereby to reduce the number of crypts and glands per square millimeter. Reduction in their number is roughly proportional to the pressure used in producing the distention. This holds true until the pressure has reached approximately one hundred millimeters of mercury. Above this pressure the mucosa is ruptured (in the rat stomachs) and rupture of the stomach wall occurs at about one hundred thirty-five millimeters of mercury.

4. See also the study with S. P. Miller.

JOHN H. SCHAEFFER, M.D., Mayo Foundation Fellow in Pathology.

The Normal Weight of the Adult Human Pancreas. *Anatomical Record*, 29:395. 1925. (Under the direction of J. A. Harris and R. E. Scammon.)

A quantitative study has been made of the weight of the pancreas in a series of individuals of twenty-one years and over in age. The material consisted of the published records and of 210 cases collected by the author from autopsies at the Mayo Clinic. A statistical study of this material gives the following results: The provisional normal weight for the male pancreas is 91.64 grams, with a standard deviation of 23.09 grams and a coefficient of variation of 25.10 per cent. The provisional normal weight for the female pancreas is 85.42 grams, with a standard deviation of 22.05 grams and a coefficient of variation of 25.81 per cent. Fatty pancreases are both heavier and more variable than normal ones. There is a small definite positive correlation between pancreas weight and body weight, in maturity, in both males and females. There is apparently a significant negative correlation between pancreas weight and age in the female, but this has not been found in the male. There is apparently a low positive correlation between pancreas weight and body weight in the male, but this correlation was not found in the female.

CHARLES H. WATKINS, M.A., Teaching Fellow in Anatomy.

1. A Quantitative Study of the Growth of the Arterial System of the Human Fetus. (Thesis for the M.A. degree; R. E. Scammon, Adviser.)

A study of the growth of the human vascular system by the examination and measurement of the aorta and the larger arterial trunks in a series of fetuses ranging in age from the fourth fetal month to birth, and by the treatment of these data by some of the methods of graphic and numerical analysis. Determinations were made of the age and size of the specimens, the total mass of the body, and of the various parts of the vascular system, the caliber of the vessels, and the thickness of the vessel walls as a whole, and of their several coats.

*Conclusions.*—(a) The growth in weight of the arterial system follows the general course characteristic of the growth in body weight of the body as a whole and of its parts. (b) The growth in weight of the various segments of the arterial system appears to be directly proportional to the growth in weight of the heart and of the body part supplied. (c) The relative rate of growth of the arterial system is most rapid in the fifth fetal month. (d) There is indirect evidence indicating a relatively rapid growth in length of the thoracic and abdominal aortae in the fourth and fifth fetal months. (e) Several arterial trunks, particularly the umbilical and common iliac arteries, appear to be greatly influenced by the growth of the placenta as well as by the growth of the body.

2. The Reactions of the Various Cellular Elements of the Omentum and of the Subcutaneous Connective Tissue in Aseptic Inflammation. (See under Department of Animal Biology.)

3. See also the study with C. A. Stewart.

## BACTERIOLOGY AND IMMUNOLOGY

WINFORD P. LARSON, M.D., Professor of Bacteriology and Immunology and Director of the Department of Bacteriology and Immunology.

1. (With H. O. Halvorson.) The Effect of Concentration in the Neutralization of Toxin by Sodium Ricinoleate. *Proceedings of the Society for Experimental Biology and Medicine*, 22:550-52. 1925.

In the neutralization of bacterial toxins by sodium ricinoleate, the authors pointed out that the proper balance of soap and toxin is not determined by the actual weight of soap and toxin present but by the concentration of the two substances.

2. (With Woodard Colby.) Immunization against Scarlet Fever Using Sodium Ricinoleate As a Detoxifying Agent. *Proceedings of the Society for Experimental Biology and Medicine*, 22:549-50. 1925.

3. (With E. W. Hancock and Howard Eder.) Antidiphtheritic Immunization Using Sodium Ricinoleate As a Detoxifying Agent. *Ibid.*, 22:552-53. 1925.

4. (With R. D. Evans and E. Nelson.) The Effect of Sodium Ricinoleate upon Bacterial Toxins, and the Value of Soap-Toxin Mixtures As Antigens. *Ibid.*, 22:194. 1924.

5. (With E. Nelson.) The Antigenic Properties of Pneumococci and Streptococci Treated with Sodium Ricinoleate. *Ibid.*, 22:357. 1925.



6. (With G. E. Fahr.) A New Antipneumococcus Serum: Preliminary Report of Its Effect upon the Course of Pneumococcus Pneumonia. *Minnesota Medicine*, 8:424-28. 1925.

7. (With H. O. Halvorson, R. D. Evans, and R. G. Green.) The Detoxification of Bacterial Toxins by Surface Tension Depressants. *The Third Colloidal Symposium Monograph*. (In press.)

It was found that sodium ricinoleate would detoxify bacterial toxins without destroying their antigenic properties. In attempting to analyse the mechanism of the detoxification, the authors arrive at the conclusion that it is due to an adsorption phenomenon in which the concentration of both the toxin and the soap is of prime importance. It was further found that the concentration of the toxin was more important than the amount given as regards its toxic effect upon the animals as well as upon its antigenic stimulus.

8. See also the study of Marie Connelly, and the joint investigation with F. W. Schlutz (Department of Pediatrics).

ARTHUR T. HENRICI, M.D., Professor of Bacteriology and Immunology.

1. The Rate of Spore Formation in Bacteria. *Proceedings of the Society for Experimental Biology and Medicine*, 22:197-99.

Previous observations having shown that the degree and duration of increase in size of cells of bacteria during the period of active growth is dependent upon the size of the initial seeding and the concentration of nutrients in the medium, it was thought desirable to test the effect of these factors on a morphological character of the resting stage, namely spores. It was found that spore formation proceeded more rapidly and began earlier with heavy initial seedings and with dilute media than when the reverse conditions obtained.

2. A Statistical Study of the Form and Growth of the Cholera Vibrio. To appear in the *Journal of Infectious Diseases*.

The area of the projected image of bacterial cells divided by the length squared, called the area length index, serves satisfactorily as a measure of form in quantitative studies of the morphology of bacteria. Variations in the form of the cells of the cholera organism at all stages of growth have been studied by this method and have been correlated with variations in the rate of growth. It is found that the organism presents consecutively three types of cells: a straight rod form during the period of positive acceleration of growth; a curved rod form (the vibrio form) when growth decreases in velocity; and irregular forms becoming finally spherical during the death phase of the culture. Since practically all of the forms previously described as variants or mutations of this organism were found at one stage or another of the culture, it is probable that these apparent mutations are due merely to variations in the rate of growth, either inherent in the strain or brought about by variations in the culture medium.

3. On Cytomorphosis in Bacteria. To be published in *Science*.

A summing up of various quantitative studies of morphological variations in bacteria, with presentation of a new theory to explain these variations. The cells of bacteria undergo a regular metamorphosis during the growth of a culture similar to the metamorphosis exhibited by the cells of a multicellular organism during its development, each species presenting in turn three types of cells, an embryonic form, an adult form, and a senescent form. These changes are, as in multicellular organisms, dependent on the metabolic rate, the change from one type to another occurring at the points of inflection of the growth curve. The embryonic form persists as long as growth is accelerating, the mature form appears with negative acceleration, and

the senescent forms develop in the death phase. The term "cytomorphosis" applied by Minot to progressive cell changes in multicellular organisms more clearly expresses the real nature of the morphological variations in bacteria than does the term "life-cycle." Fundamentally there is no great difference between the growth of a population of one-celled organisms and the growth of a multicellular organism.

#### 4. Influence of Nutrients on the Growth of Bacteria.

Both the rate of growth and the final yield of bacteria are dependent on the concentration of nutrients in the medium; within certain limits the amount of growth is proportional to the concentration of the medium. The cessation of growth, and death, are apparently due to exhaustion of the medium, since the addition of further nutrients will cause a rejuvenation and further growth. Nevertheless the medium is not completely exhausted since removal of the organisms (save a very few left for seeding) will permit a second, third, and fourth crop in the same medium.

The work in progress aims to determine the rates of growth and final yields in these successive crops, the amount and nature of the food material used in each successive crop, and the influence of variations of the composition of the medium (ratios of nitrogen to carbon, etc.) on the rate of growth and final yield. So far the results are somewhat contradictory and no conclusions can be drawn.

ROBERT G. GREEN, M.A., M.D., Associate Professor of Bacteriology.

1. (With H. O. Halvorson.) Surface Energy As the Controlling Factor in Agglutination and Dispersion. *Journal of Infectious Diseases*, 35:5-13. 1924.

Mathematical consideration was given to a system representative of a suspension of bacteria in an unstable state, considering distribution of surface energies at various interphases. An equation was deduced relating change in surface with any change in free energy of the system. It was shown that surface tension may act to cause dispersion of cells and maintain a stable suspension as well as bring about agglutination.

2. Inhomogeneous Systems with Applications to Suspensions of Blood Cells. (See abstract under F. H. MacDougall, Department of Physical Chemistry.)

3. Distemper in the Silver Fox (*Culpes Vulpes*). *Proceedings of the Society for Experimental Biology and Medicine*, 22:546-48. 1925.

A disease of the silver fox, known as distemper because of its similarity to dog distemper, has been studied by experimental transmission into well foxes. A primary disease was obtained which is very similar to typhoid fever in man, showing characteristic intestinal lesions, sometimes with extensive ulceration and an enlarged spleen. An organism was isolated belonging to the group of *Salmonella*, which, upon injection into foxes, reproduces the typical disease; and the organism may be recovered subsequently in pure culture.

4. The Mechanism and Significance of the Fragility Test. *Proceedings of the Society for Experimental Biology and Medicine*, 22:308-11. 1925.

Blood cells which have been immersed in a dilute solution of sodium ricinoleate and then removed show an increased resistance to hemolysis by hypotonic salt solution. As these cells were undergoing a slow hemolysis from the action of the soap, they represent injured cells. Electrical conductance measurements of such soap treated cells show a decreased electrical resistance. This indicates that soap treated cells exhibit an increased permeability to salts. If normal blood cells are successively transferred through hypotonic salt solutions, it has been found that they can be carried into more dilute salt solutions without hemolysis than if they were transmitted directly from a 0.9 per cent solution into the most dilute solution. These experiments indicate

that an increased resistance to hypotonic salt solution represents an injury to the cells so that salts pass out of the cells more readily than normally. Some observations were also made on the blood in pernicious anemia.

5. A Study of the Ring Method of Surface Tension. (See abstract under F. H. MacDougall, Department of Physical Chemistry.)

6. See also the studies with W. P. Larson, and with M. Visscher (Department of Physiology and Physiological Chemistry).

HALVOR O. HALVORSON, B.S., Chem. Eng., Instructor in Bacteriology.

1. The Preparation of Pure Sodium Ricinoleate. *Proceedings of the Society for Experimental Biology and Medicine*. 22:553-55. 1925.

A paper giving a method by which chemically pure sodium ricinoleate may be prepared.

2. Observations on the Measurement of the pH of Soap Solutions. *Proceedings of the Society for Experimental Biology and Medicine*, 22:358-61. 1925.

A paper pointing out the difficulties involved in measuring the pH of soap solutions, and pointing out methods for determining the pH of unsaturated soap solutions.

3. (With R. G. Green.) The Effect of Surface Energy on Colloidal Equilibrium. *The Second Colloidal Symposium Monograph*. (In press.)

A mathematical paper showing how the surface energy is able to maintain colloidal stability. It is shown that surface energy can maintain or bring about aggregation of colloidal particles. A formula giving the distribution of surface energies in a colloidal solution is given.

4. See also the studies with W. P. Larson.

ROBERT L. STARKEY, Ph.D., Instructor in Bacteriology.

1. Concerning the Carbon and Nitrogen Nutrition of *Thiobacillus Thiooxidans*, an Autotrophic Bacterium Oxidizing Sulfur under Acid Conditions. *Journal of Bacteriology*, 10:165-95. 1925.

Organic materials of no kind appear necessary to the rapid functioning of this organism and will not support growth as the sole sources of energy. They may be affected by growth of the organism in sulfur media and may produce marked effects upon development of the organism. Glucose disappears progressively from developing cultures. It is not essential nor decomposed by the sulfuric acid produced by oxidation of sulfur. It appears that small amounts of glucose may enter into the metabolism of the cells in the presence of sulfur as a source of energy. Citric acid inhibits growth in concentrations lower than the concentrations of sulfuric acid which are tolerated. Nitrogen in the form of ammonium compounds appears to be the sole source of the element available to the organism. Oxidation was depressed in the presence of all concentrations of nitrate and completely inhibited at 1 per cent  $\text{KNO}_3$ . Decrease in the economy of utilization of energy is proportional to the amount of nitrate added. The injurious effects of nitrate are specific for the anion and not due to any great extent to the osmotic effects which might be created by additions of the salts. Neither urea, nor peptone, nor amino acids appear to be available as sources of nitrogen, carbon, or energy. Concentration of 2.5 per cent peptone inhibited growth.

2. Concerning the Physiology of Thiobacillus Thiooxidans, an Autotrophic Bacterium Oxidizing Sulfur under Acid Conditions. *Journal of Bacteriology*, 10:135-63. 1925.

Investigations were reported which were concerned with some phases of the physiology of the sulfur oxidizing bacterium. Oxidation was most rapid in the early periods of development of the culture and subsequent retarded growth was apparently due to the continued accumulation of sulfuric acid produced by the oxidation of sulfur. The energy liberated by oxidation of thiosulfate was less completely utilized than that liberated during oxidation of sulfur. Phosphates in considerable concentrations did not greatly alter the economy of energy utilization. Several inorganic salts of heavy metals failed to produce appreciable stimulating effects on growth. Not alone rhombic sulfur but also the amorphous and precipitated forms are about equally available to the organism. Growth ceases in the absence of either oxygen or carbon-dioxide. The cells of the organism do not appreciably deteriorate in aged cultures but are extremely sensitive to desiccation, dying quickly in either soil or sulfur where the moisture content falls below 1 to 3 per cent.

MARIE CONNELLY, M.A., Graduate Student.

Studies on Botulinus Toxin. (Thesis for the M.A. degree; under the direction of W. P. Larson.)

The purpose of the study was the observation of the effect of a solution of castor oil soap upon the toxin of bacillus botulinus. The specific project includes (1) detoxification of botulinus toxin and (2) immunization of small laboratory animals, using the toxin treated with soap as an antigen. The procedure consisted in mixing a given volume of the toxin (toxicity previously determined) with an equal volume of the clear soap solution. After allowing the mixture to stand a given length of time the mixture was injected subcutaneously into guinea pigs. It was noted that: (1) Toxin may be detoxified by treating with soap, providing the soap toxin mixture is allowed to stand at least three hours before injection; (2) The soap toxin mixture acts as an antigen, with increasing immunity in the animals after an increased number of injections.

## MEDICINE

GEORGE E. FAHR, B.S., M.D., Associate Professor of Medicine.

1. Myxedema Heart. A Study of Heart Failure in Cases of Insufficient Function of the Thyroid Gland. Clinical, X-Ray, and Electrocardiographic Study. *Journal of the American Medical Association*, 84:345-49. 1925.

2. Study of the Retinal Changes in Hyperpiesia and in Glomerulonephritis for the Purpose of Developing a Method for the Differentiation of These Two Conditions, Showing the Difference in the Essential Pathological Processes.

Undertaken jointly with Walter E. Camp, making use of clinical studies, ophthalmoscopic examinations, and histological studies of the retina and kidneys.

3. Study of the Various Physical Factors Involved in the Production of Nephropathic Edema. (Undertaken jointly with W. W. Swanson.)

An investigation making use of clinical material, examination of blood plasma and edema fluids, by means of chemical analysis, surface tension measures, and osmotic pressure determinations. Carried out with the aid of a research grant with the Ella Sachs Plotz Foundation.



4. (With Cecil J. Watson.) Production of Infarct of the Kidney by Means of the Injection of Silica Jell into the Renal Artery.

#### 5. Hypertension Heart.

A study of the clinical features of this type of heart disease. Clinical examinations and follow-ups, result of autopsy examination, determination of the time necessary to produce heart failure.

6. A New Antipneumococcus Serum. (See title listed under W. P. Larson, Department of Bacteriology and Immunology.)

J. CHARNLEY MCKINLEY, Ph.D., M.D., Associate Professor of Neuro-pathology, Division of Nervous and Mental Diseases.

1. (With L. R. Gowan.) Neuron Destruction in Postencephalitic Paralysis Agitans: A Micrometric Study of the Lenticular Region and Substantia Nigra. To be published in the *Archives of Neurology and Psychiatry*.

In two cases of postencephalitic paralysis agitans studied by ordinary histologic methods, minimal *globus pallidus* changes but massive *substantia nigra* lesions are found. Scattered lesions found in other parts of the brains are so insignificant as to require no intensive investigation. The two foregoing cases and a previously reported case have been studied by micrometric methods in order to evaluate mathematically the amount of cell destruction in the lenticular region and *substantia nigra*. Comparing with three normal cases similarly studied, no decrease in the number of cells in the *putamen* or *globus pallidus* can be demonstrated. An average decrease in number of neurons of from 59 to 87 per cent has occurred in the *substantia nigra* of the three cases. From these data it appears that the syndrome of paralysis agitans may occur without a significant lesion in the *globus pallidus*, though this is not intended to mean that the *globus pallidus* never plays a rôle in parkinsonianism. The *substantia nigra* destruction seems to be the essential factor in the production of the syndrome, at least in the three cases presented. Micrometric methods are of great value to the neuro-pathologist and should be more commonly employed.

2. (With L. B. Dickey.) Subacute Combined Degeneration of the Spinal Cord without Pernicious Anemia: Report of Two Cases with Autopsy Findings. To be published in the *Journal-Lancet*.

The occurrence of subacute combined degeneration of the spinal cord without pernicious anemia is frequently observed clinically, but published reports with autopsy findings are extremely rare. In Case I there were no evidences of pernicious anemia clinically or pathologically. The clinical and pathological picture of subacute combined degeneration was present in typical form. Case II likewise presented a classical subacute combined degeneration without clinical evidences of pernicious anemia. But pathologically the bone marrow showed a very early hyperplasia of the cellular elements indicative of pernicious anemia with no other findings of the condition. This case evidently represents an intermediate stage in which the patient was just beginning to develop pernicious anemia at the time of exodus. No other cases demonstrating this transitional period pathologically are on record so far as can be determined; hence this case has a very special significance in proving pathologically that subacute combined degeneration and pernicious anemia are different manifestations of the same disease. Both cases show that individuals may die from causes incidental to the lesions of subacute combined degeneration before the development of pernicious anemia.

3. Neuropathology. A chapter in E. T. Bell's *Outlines of Pathology*. Minneapolis: University of Minnesota. 1924. Pages 194-255.

The chapter is a brief dissertation on neuropathology for the use of medical students.

MOSES BARRON, B.S., M.D., Assistant Professor of Medicine.

Diseases of the Pancreas: A Pathological Study, with Report of Cases. To be published in the *Archives of Internal Medicine*.

A study of the autopsy material in the Department of Pathology of the University of Minnesota, extending over a period of several years. An attempt was made to correlate the clinical symptoms with the pathological findings. Several cases were studied clinically in great detail. The conclusions arrived at were that pancreatic disease is more common than is usually supposed and that carcinoma of the pancreas, both primary and secondary, is the most common lesion encountered. Chronic pancreatitis and acute pancreatic necrosis are next in importance. Frequent urine examinations together with blood sugar estimations and sugar tolerance tests are valuable aids in diagnosis of pancreatic diseases. Diabetes as a result of pancreatic atherosclerosis is rather frequently associated with cases of advanced hypertension and coronary sclerosis.

THOMAS ZISKIN, M.D., Instructor in Medicine.

1. Vital Capacity As a Functional Test in Heart Disease. *Archives of Internal Medicine*, 35-259-65. 1925.

2. A Cardiac Sign of Bronchial Node Enlargement. Read at the meeting of the National Tuberculosis Association, June, 1925.

3. An Investigation of the Size and Development of the Heart in Children, by Means of the Teleroentgen Method. (To be published soon.)

4. A Study of the P Wave in Mitral Stenosis. (To be published soon.)

LAWRENCE R. GOWAN, B.A., M.D., M.S. in Nervous and Mental Diseases, Teaching Fellow in Nervous and Mental Diseases.

Neuron Destruction in Postencephalitic Paralysis Agitans. (Thesis for the degree of M.S. in Mental and Nervous Diseases; see under J. C. McKinley, Adviser.)

ALEXANDER E. VENABLES, M.D., Miller Hospital Fellow in Medicine.

Quinidine: An Intensive Study with Relation to Its Pharmacological Action on the Cardio-Vascular System; also a Study of the Other Forms of Quinine, the Alkaloid, Quinine Bisulphate, and Quinine Sulphate. (Thesis for the Ph.D. degree; under the direction of R. E. Morris.)

This work is being carried out through the method employed in previous studies of digitalis and of Strophanthus Kombe by R. E. Morris. We are determining in cat units a dosage of quinidine, and the other quinine derivatives, a drug now being extensively used to correct cardiac irregularities, with various and sometimes fatal results. As in digitalis, we find a definite therapeutic range, followed by a definite toxic period up to the lethal dose. So we hope to be able to give definitely a proper dosage, governed by weight and conditions.

## OBSTETRICS AND GYNECOLOGY

JENNINGS C. LITZENBERG, B.S., M.D., F.A.C.S., Professor and Chief of the Department of Obstetrics and Gynecology.

1. Unruptured Interstitial Pregnancy, with Anatomic and Histologic Report of an Early Case. *American Journal of Obstetrics and Gynecology*, Volume 9, No. 1. January, 1925.

The first serial section study of the entire body of the uterus containing an interstitial (intramural tubal) pregnancy. The conclusions are as follows: (a) Inter-

stitial pregnancies are always found within the musculature of the uterus because of the early rupture of the tube. (b) The age of this ovum is probably less than three weeks, inasmuch as the uterus was removed twelve days after the date of the expected but skipped menstruation. (c) Rupture of the tube and escape into the uterine musculature occurred before this. (d) At the site of implantation and rupture the lumen of the tube measured 4 mm. in diameter or two and a half times the normal measurement, hence the tube must have ruptured when it had attained this size. (e) The site of implantation and rupture is proved by finding the tube dilated and villi within the dilated portion and in the wall at the point of rupture. (f) No uterine glands were seen in the tube beyond the uterine ostium. (g) The transition from uterine to tubal epithelium is rapid but not abrupt. (h) The tubal musculature is distinct from the uterine muscle but the outer layer is not always easy to differentiate. (i) The uterine muscle hypertrophies very early and the wall is thicker on the pregnant side. (j) True decidua is found only in the uterine cavity. (k) "Decidual reaction" is present in both tubes but is entirely absent in the ovum capsule. (l) The so-called "decidua-like" cells are probably trophoblastic in origin. (m) Hemorrhage in the uterine cavity originates within the decidua, and bleeding elsewhere probably also originates locally. (n) Interstitial pregnancy repeats most of the features of ectopic gestation elsewhere, modified, however, by the peculiar anatomic conditions of its location.

## 2. Study of Basal Metabolism in Sterile Women.

Clinical cases of sterility in some instances have shown a moderately low basal metabolism. Marked hypothyroidism has long been known to be a cause of sterility but a few patients in apparently good health but sterile have been found to have a very mild degree of hypothyroidism and have conceived after carefully supervised thyroid medication. Several pregnancies have occurred after this treatment. The investigation is not yet completed.

## 3. (With Donald de Carle.) Hypothyroidism and Fecundity.

Animal experimentation, investigating the effect of induced hypothyroidism upon fecundity, is now under way.

## 4. Parallel Microscopic Studies of the Uterus, Fallopian Tubes, Ovaries, and Vagina.

Material collected from autopsies of infants, children, and adults. Microscopic (paraffin) sections of entire organs are made. The object of this investigation is to study the life cycle of the internal organs of generation simultaneously, i.e., to find the gross and microscopic changes from birth to old age and also the monthly cycle by similar comparisons of all these organs for every day of the menstrual cycle.

## 5. Tubal Pregnancy.

A continuation of the serial section studies of the entire pregnant Fallopian tube, a preliminary report of which was published in the *American Journal of Obstetrics and Gynecology*, Vol. I, No. 3. December, 1920.

## 6. Technique of Preparation of Microscopic Sections of Whole Organs.

For more than five years our serial microscopic sections of whole organs have been limited to celloidin imbedding, but we have during this time tried, unsuccessfully until very recently, to employ paraffin. In January, 1925, we finally perfected the paraffin imbedding technique which depends for its success: first, on cutting gross slabs of the organs not more than two centimeters thick, as we find that paraffin will infiltrate one centimeter each way; second, the sections must be cut with a brain microtome. Other details of the technique are essentially the same as in cutting block sections.

## 7. See also the study with R. E. Swanson.

ROY E. SWANSON, B.S., M.D., Teaching Fellow in Obstetrics and Gynecology.

Growth Dimensions of the Human Female Pelvis from Birth to Maturity. (Thesis for the Ph.D. degree in Obstetrics and Gynecology; under the direction of J. C. Litzenberg and R. E. Scammon.)

Purpose is to determine by the study of a fairly large series of normals the rate of growth of various pelvic measurements, to determine comparative rates of development and to attempt by statistical study of these measurements to arrive at a definite opinion regarding the rate of growth of these measurements, and their relative rates. These measurements include the height and weight and other various circumferences to see if there is any definite relation between these and the pelvic measurements. Work in progress.

FRED L. ADAIR, M.A., M.D., F.A.C.S., Associate Professor of Obstetrics and Gynecology.

1. (With R. E. Scammon.) Study of the Growth and Closure of the Fontanelles of the Newborn and Later Infants.

2. (With Hulda Thelander.) The Ratio between Placental Weight, Volume, and Dimension, and the Newborn Weight. *American Journal of Obstetrics and Gynecology*. (In press.)

In this paper the following conclusions are drawn: (1) Positive correlation exists between the weight of the newborn and (a) the weight of the placenta, (b) the volume of the placenta, and (c) the surface area of the placenta. (2) Thin placentas are either proportionately small or a disproportion between the volume and the surface area exists, due to some pathologic condition. (3) Thick placentas in the same way are either proportionately large placentas or have a disproportion between the volume and the surface area. (4) The average specific gravity is 1.028. The more nearly perfect placentas have a low specific gravity and the degenerating placentas have higher specific gravity. (5) A low ratio of weight of the baby to the weight of the placenta is found in prematures, very small babies which are really on the borderline of prematurity, and in pathological cases, especially those where toxemia of pregnancy is present. (6) A high ratio is found chiefly in postmature or large infants. (7) A marginal insertion of the cord indicates a pathological placenta and almost always means a small baby. (8) The average weight, volume, and surface area are higher for placentas from multiparae than for those from primiparae.

3. Studies in Placental Pathology with Particular Reference to Certain Degenerative Processes Called Infarcts.

A work has already been published regarding this in the *American Journal of Obstetrics*. Further work is in progress on this problem.

4. Influence of Diet on Lactation. *American Journal of Obstetrics and Gynecology*, Volume 9, January, 1925.

The following conclusions were drawn: It is difficult, if not impossible, to draw absolute conclusions regarding the quantitative effect of diet upon the mammary secretion. It is quite obvious that the nursing mothers ate more than necessary of both the high carbohydrate and high fat diets. This was especially true of the latter. This excess diet had no apparent effect on stimulating milk production. A high caloric feeding might be objectionable in view of the not infrequent observation that rapid increase of weight in nursing mothers is not uncommonly associated with a decreasing milk supply. The milk ingestion and weight increase of the infants in the neonatal period would seem to indicate that the milk secretion increases more steadily on the rations which contain a liberal amount of protein. These diets were also mixed and



did not run to an excess of any of the ingredients. The hospital, high protein, and balanced diets seemed to meet the needs of the mother and infant, without excessive caloric intake, better than either the high fat or high carbohydrate diet. This is not in accord with common practice in relation to the pushing of certain types of feeding in nursing mothers. Further work is in progress along this line.

#### 5. Investigation into the Causes of Morbidity and Mortality in the Newborn Infant.

This work has been conducted in conjunction with the Department of Pathology represented by Doctors W. J. O'Brien, Roger Kennedy, D. C. Mebane, Edith Boyd, and Ethel Harrington. This work is still being carried on, and has served as a basis for the publication of several articles.

#### 6. (With Morris N. Nathanson.) Vital Capacities during Pregnancy.

#### 7. (With Leo Rigler.) X-ray Studies of Some Conditions Associated with Pregnancy.

#### 8. (With D. E. Ziskin.) Study of Oral Conditions Associated with Pregnancy.

The last three studies are in progress in the Minneapolis General Hospital.

#### 9. (With K. A. Phelps.) A Study of the Ocular Conditions in the Newborn.

10. See also the studies by J. W. Bell, W. W. Swanson, R. L. Kennedy, E. J. Simons, C. E. Proshek, J. A. Urner, and M. Kerlanski.

ROGER L. KENNEDY, B.S., M.D., Mayo Foundation Fellow.

#### 1. Duodenal Ulcer and Melana Neonatorum. (Under the direction of F. L. Adair.) *American Journal of Diseases of Children*, December, 1924.

The following conclusions were drawn: In the light of the findings, and of those reported by Helmholz, it would appear that by more careful search of the gastrointestinal tract, a much larger number of ulcers will be found, macroscopically as well as microscopically, in explanation of melena of the newborn infant. This work has been conducted in part by the financial support received from the Children's Bureau of the U. S. Department of Labor.

#### 2. Syphilis of the Newborn. (Under the direction of F. L. Adair.)

DONALD C. MEBANE, M.D., Mayo Foundation Fellow.

#### The Significance of the Nephrogenic Zone of the Kidney in the Normal and Syphilitic Fetus and Newborn. (Under the direction of F. L. Adair.) *American Journal of Diseases of Children*, December, 1924.

The following conclusions were reached: (1) The histologic study of the normal kidneys in 162 fetuses and newborn infants shows that the development of the renal tubules is completed when the infant is between 45 and 48 cm. in length. (2) At birth in the full term infant (from 48 to 52 cm.) the growth zone or nephrogenic zone of the kidney is absent. (3) The nephrogenic zone is usually absent when the weight of the dead infant is more than 2,500 gm. (4) The study of the kidneys in 14 patients with congenital syphilis failed to show in a single instance a retardation in the development of the kidney with a persistent neogenic zone. (5) In congenital syphilis, the nephrogenic zone disappeared at the same time as it did in the control series, when the infant was between 45 and 48 cm. in length. (6) The presence of the neogenic zone is almost certain evidence of prematurity. Its prominence, whether slight, moderate, or marked, may give some idea of the age of the fetus.

J. WARREN BELL, M.D., Ph.D. in Obstetrics and Gynecology.

Study of Vital Capacity during Pregnancy. (Thesis for the Ph.D. degree; F. L. Adair, Adviser.)

CHARLES E. PROSHEK, B.S., M.D., Fellow in Obstetrics and Gynecology.

Symposium. (Under the direction of F. L. Adair and R. E. Scammon.) To be published in the *American Journal of Obstetrics and Gynecology*.

A detailed study of this type of monstrosity.

WILLIAM W. SWANSON, M.S., M.D., Teaching Fellow in Pediatrics.

Study on the Chemical Composition of the Amniotic Fluid. (Under the direction of F. L. Adair.)

MILTON KERLANSKI, B.S., M.D., Medical Intern.

Efficacy of the Methods of Preparation of Parturient Women, with a View to the Prevention of Infection. (Under the direction of F. L. Adair.)

EDWIN J. SIMONS, B.S., M.D., Medical Intern.

(With C. C. Rasmussen.) Blood Pressures during Pregnancy, Labor, and Puerperium. (Under the direction of F. L. Adair.) *Minnesota Medicine*, May 18, 1925.

From this work the following conclusions were drawn: (1) That there is an irregular but gradual rise in systolic, diastolic, and pulse pressures, and pulse rate during pregnancy. This is true of both average and modal pressures. (2) That there is a sudden rise of pressures and pulse rate during labor, a marked decrease immediately after delivery, and a gradual decrease from that time until six weeks postpartum, when a normal pressure has been reached. (3) In pre-eclamptic toxemia the blood pressure shows a marked initial decrease after labor, a secondary rise with a subsequent slower and gradual return to its previous or more normal level. (4) That systolic blood pressure shows the greatest range of variability, diastolic the least, while pulse pressure and pulse rate fluctuate more or less but still coincide fairly well with the general tendency of the other factors.

Observations were also made concerning the loss of blood under various conditions.

JOHN A. URNER, B.S., M.D., Medical Intern.

Study of the Immunity of Newborn, with Relation to the Recent Epidemic of Smallpox and the Effect of Smallpox on Pregnancies. (Under the direction of F. L. Adair.)

## OPHTHALMOLOGY AND OTO-LARYNGOLOGY

FRANK E. BURCH, M.D., F.A.C.S., Associate Professor of Ophthalmology.

1. The Influence of High Blood-Pressure in Cataract Surgery. *North-west Medicine*, 24:16. 1925.

2. Hysterical Amaurosis and Amblyopia. To be published in the *American Journal of Ophthalmology*, July, 1925.

3. Tendon Tucking: A Method of Suturing. To be published in the *Archives of Ophthalmology*, July, 1925.

4. Retinal Evidence of Circulatory Disease. Read at a meeting of the Minnesota Academy of Medicine, May 13, 1925.

## PATHOLOGY

ELEXIOUS T. BELL, B.S., M.D., Professor of Pathology, and Director of the Department of Pathology.

1. (With B. J. Clawson and T. B. Hartzell.) Experimental Glomerulonephritis. *American Journal of Pathology*, 1925.

Experimental renal lesions reported in the literature up to the present time have been either nephroses or exudative interstitial nephritis, the latter corresponding anatomically to spontaneous types of nephritis found in the laboratory animals. No lesion corresponding to human glomerulonephritis has been produced. In these experiments monkeys were injected intravenously with large doses of streptococci from human sources. Many of the monkeys died of septicemia or toxemia; and in these only cloudy swelling of the kidneys was produced. Two monkeys showed severe nephrosis of a necrotic type, and one showed acute interstitial nephritis. In one monkey an early stage of chronic glomerulonephritis developed. In this animal there were many epithelial crescents, and numerous examples of intracapillary glomerulitis. A number of glomeruli showed complete closure of the capillary tufts with resulting atrophy of the associated tubule. In three other monkeys that are still living there are clinical evidences of glomerulonephritis, viz., heavy albuminuria, hematuria, and edema.

2. See also the studies with F. J. Heck and C. J. Watson.

BENJAMIN J. CLAWSON, Ph.D., M.D., Associate Professor of Pathology.

1. The Myocardium in Non-infectious Myocardial Failure. *American Journal of the Medical Sciences*, 168:648. 1924.

The purpose is to determine the extent and character of the anatomical changes in the myocardium in chronic myocardial failure and to find the cause of these changes.

*Material.*—A detailed gross and microscopic study was made of the myocardium in 102 hearts. Of these 102 hearts, 37 were cases of hyperpiesia; 7, cases of hyperpiesia where death resulted from cerebral hemorrhage; 3, cases of chronic glomerulonephritis; 4, right ventricular hypertrophy and dilation; 19, coronary sclerosis; 21, old healed defective valves; 9, luetic aortitis; and 2, cases with adherent pericardium.

*Conclusions.*—There are no anatomic changes except coronary sclerosis and myocardial fibrosis. The fibrosis, as a rule results from the coronary sclerosis. Myocardial strain is not a cause of myocardial fibrosis. Myocardial failure is rarely due to anatomic changes in the myocardium.

2. Studies on the Etiology of Acute Rheumatic Fever. To be published in the *Journal of Infectious Diseases*.

The organisms were isolated from twenty cases of well-defined acute rheumatic fever, or chorea. They were tested in respect to morphology, cultural characteristics, immunologic reactions, and ability to produce experimental endocarditis in rabbits.

*Conclusions.*—In a relatively high percentage of cases of acute rheumatic fever, a streptococcus can be isolated from the blood. This streptococcus generally belongs to the viridans group and does not represent a specific strain. Agglutinins for streptococci in dilutions of 1 to 50 can be found in the blood of acute rheumatic patients. Lesions similar to those occurring in human rheumatic lesions can be produced experimentally in animals by injecting streptococci. There seems to be ground for the belief that rheumatic fever with its associated lesions is produced by streptococci.

A positive blood culture in liquid medium should not be considered a basis for a positive diagnosis of subacute bacterial endocarditis.

3. A Comparison of Acute Rheumatic and Subacute Bacterial Endocarditis. Submitted to the *Archives of Internal Medicine* for publication.

A comparison of eighty cases of subacute bacterial endocarditis is made with thirty-five cases of acute rheumatic endocarditis in respect to (1) the blood picture, (2) the gross and microscopic anatomic characteristics, and (3) the bacteriology.

*Conclusions.*—The leucocyte count is of little value in differentiating rheumatic from subacute bacterial endocarditis. A severe secondary anemia strongly suggests the subacute bacterial type. The anatomic differences are in degree rather than in kind. The streptococci, usually the viridans strains, seem to be responsible for both rheumatic and subacute bacterial endocarditis. From the comparison one gets the impression that these two forms of endocarditis represent mild and severe degrees of the same infection.

JAMES S. MCCARTNEY, Jr., B.A., M.D., Assistant Professor of Pathology.

#### The Changes in the Human Liver in Obstructive Jaundice.

The material used consists of portions of ninety-four livers (sixty-two of them from the Mayo Clinic) in which the jaundice, of different durations and intensities, may unquestionably be ascribed to obstruction. The study shows (1) that hepatic changes do occur in obstructive jaundice; (2) that they are progressive in character, depend upon the duration and intensity of the jaundice, and lead to an anatomic and clinical cirrhosis in 10 per cent of the cases.

This paper is being prepared for publication.

THEODORE H. SWEETSER, B.S., M.D., Instructor in Pathology.

#### Prostatectomy: A Review of Cases Treated under Different Conditions.

The purpose of the study is: (1) comparison of results obtained under different circumstances; (2) comparison of our Minneapolis methods and results with those reported from other regions; (3) demonstration of the great importance of pre-operative investigation and care; (4) analysis of the factors causing difficulties in treatment and untoward results.

The material consists of case reports from (1) St. Mary's Hospital, Minneapolis; (2) Minneapolis General Hospital; (3) Necropsy records, Department of Pathology, University of Minnesota.

A part of this review was presented before the staff of St. Mary's Hospital in November, 1922; another part was presented before the North Central Branch of the American Urological Association in the autumn of 1923. The scope of the study is now being broadened and the work brought down to date for presentation as a thesis before the Minneapolis Surgical Society.

FRANK J. HECK, B.S., M.S., Teaching Fellow in Pathology.

Experimental Tar Cancer in Mice. (Thesis for the M.S. degree; E. T. Bell, Adviser.)

The purpose of the experiments was to determine in what fraction of coal tar the carcinogenic substance is to be found and to determine if possible the substance or substances responsible for this property. This is a preliminary report on the action of the whole tars. Experiments are in progress on the action of a high boiling fraction of the tars, distilling above 320° C.

White mice were painted on the rear portion of the back with a thin coat of tar three times a week. Two different tars were used with different series of mice, one obtained from a horizontal type of retort, the other from a Koppers coke oven.

*Conclusion.*—Of eighteen mice surviving five and one-half months of painting, 1 was entirely negative, 1 showed a proliferative type of lesion resembling sarcoma,



1 a precancerous lesion, 3 early squamous cell carcinomas, 7 fairly well-developed squamous cell carcinomas, and 1 a sarcoma. Four of the 18 were not examined because of autolytic changes.

CECIL J. WATSON, B.S., M.S., Teaching Fellow in Pathology.

1. Periarthritis Nodosa. (Thesis for the M.S. degree; E. T. Bell, Adviser.)

A chart of 86 cases was made, 5 of these coming to necropsy in this laboratory. The condition occurs predominantly in young males. Symptoms are polyneuritic, polymyositic, arthritic, gastrointestinal and renal, and with anemia, weakness, and emaciation. Hypertension and renal insufficiency are common. Fever and leucocytosis are almost constant; eosinophilia in approximately 20 per cent. The renal, coronary, mesenteric, intestinal, and pancreatic arteries are most commonly involved. The lesions may be uncomplicated, or they may result in thrombosis, infarction, atrophy, hemorrhage. In most cases they are at first acute, then subacute, and finally chronic in type. Exudation in the adventitia, degeneration of the media, and proliferation of the intima are most commonly seen. The condition is probably a complication of a streptococcic infection.

2. See also the study with G. E. Fahr.

## PEDIATRICS

FREDERIC W. SCHLUTZ, B.A., M.D., Professor of Pediatrics and Chief of the Department of Pediatrics.

1. (With M. Morse.) Note on the Photoactivity of Cod Liver Oil. *Proceedings of the Society for Experimental Biology and Medicine*. (In press.)

2. (With W. W. Swanson.) A Method for the Estimation of Urea in Saliva. *Ibid.* (In press.)

3. The Significance of Vitamines in the Diet of Infants and Children. *Journal-Lancet* 44:186-89. 1924.

4. The Diet in Tuberculosis of Children. *Ibid.*, 45:165-67. 1925.

5. The Diagnosis and Treatment of Nephritis in Children. *Minnesota Medicine*, 7:761-65. 1924.

6. The Care and Treatment of Juvenile Diabetes. *Ibid.*, 8:30-34. 1925.

7. A Report of Two Unusual Cases of Thrush. *American Journal of Diseases of Children*. (In press.)

8. The Diet of Older Infants and Children. *Archives of Pediatrics*. (In press.)

9. (With M. Morse.) Some Spectroscopic Observations on Cod Liver Oil. *American Journal of Diseases of Children*. (In press.)

In repeating the experiments of Kugelmass and McQuarrie on the photoactivity of cod liver oil, negative results were obtained. Our results gave no evidence that cod liver oil, while oxidizing, emits ultra-violet light. Investigations have shown that the antirachitic substance of cod liver oil is found in the ether-soluble unsaponifiable fraction after alkaline hydrolysis. The substance is possibly a sterol related to cholesterol or a cholesterol derivative. Since cod liver oil and ultra-violet

radiations produce apparently the same effect in preventing rickets, it is of interest to find out what, if any, common element there is between two such different factors. The absorption spectrum of cod liver oil showed some indication of two absorption bands, very shallow, while cottonseed oil showed only general absorption. It also showed that cod liver oil has greater absorption capacity for ultra-violet radiation than cottonseed oil. The unsaponifiable fraction was found to have a much greater power of absorbing ultra-violet radiation than the whole cod liver oil. Many of our findings seem to indicate that irradiated cholesterol is converted into a different, more active, but unstable compound.

Work now in progress:

10. (With W. W. Swanson.) The Uric Acid Metabolism of the New-born Infant.

11. (With M. Morse.) A Further Study of the Spectrographic Behaviour of Cod Liver Oil and Its Various Fractions.

12. (With M. Morse.) A Study of the Effect of Irradiation upon Cholesterol and an Analysis of the Behaviour of Its Absorption Spectrum.

13. (With W. P. Larson.) An Immunological Study of Pneumonia in Infants and Children and the Results of Treatment of This Condition with Antitoxin Prepared from Rabbit Serum.

14. See also the study with L. F. Richdorf.

CHESTER A. STEWART, Ph.D., M.D., Assistant Professor of Pediatrics.

1. (With E. S. Platou.) A Rational and Simple Method of Feeding Children during the First Two Years of Life. *Minnesota Medicine*, 7:717-20. 1924.

2. Thyroid Enlargement in Minneapolis Children. *Ibid.*, 8:214-18. 1925.

The percentage of thyroid glands classed as non-palpable is definitely lower at birth than at any subsequent period during the first two years of life. After the third to sixth year of age this group of undoubtedly normal thyroids progressively decreases, reaching a minimum percentage for each sex about the age of puberty. Subsequently these non-palpable glands are found with increasing frequency among the boys, but continue to be rarely present among the girls at least until the eighteenth year. The percentage of very small thyroid glands fluctuates considerably during childhood, but shows no general trend with increasing age. Slight and considerable enlargements are more prevalent at birth than at other periods during infancy. After the third year these types of enlargement increase in frequency, reaching a maximum about the age of puberty. The considerable enlargement is apparently more persistent among the girls after this period than among the boys. At no period of life was great enlargement of the thyroid gland as prevalent as hypertrophies of lesser degree. This type of enlargement is very occasionally found in infancy, and subsequently its occurrence is limited practically to girls about the time of puberty or later. Since the administration of iodine is more efficient in the prevention than in the cure of simple goiter, the prophylactic treatment of this condition probably should be instituted rather early in life.

3. Growth of the Internal Organs of Anencephalic Fetuses. (See abstract under the Department of Anatomy.)

4. See also the study with F. L. Adair, Department of Obstetrics and Gynecology.

ROOD TAYLOR, M.D., Ph.D., Assistant Professor of Pediatrics.

The Study of Chloride Metabolism in Infants. Reported at the 1925 meeting of the American Pediatric Society.

Determination of the blood chloride in normal infants at various ages, and of its effect on varied disease conditions, hunger and digestion; the correlation between blood chloride and the hydrogen ion concentration of the gastric juice; the effect upon the hydrogen ion concentration of the gastric juice and upon the baby's digestion of administering sodium chloride in the baby's food. The study was made on private patients in the Abbott Hospital and the Northwestern Hospital, and on patients in the University Hospital. The results so far show an apparent physiological diminution in the infant blood chloride beginning about the end of the first week. The feeding of sodium chloride increases the hydrogen ion concentration of the gastric juice and increases the baby's digestive ability. Work still in progress.

HYMAN S. LIPPMAN, M.D., Ph.D. in Pediatrics, Instructor in Pediatrics.

1. A Morphological and Clinical Study of Bone Marrow. (See under the Department of Anatomy.)

2. Masked Juvenile Tuberculosis.

Observations on 836 children in the out-patient department at Lymanhurst, examined from June, 1923 to June, 1924 show 107 to have suspected tuberculosis. Of these, 18 have a condition called masked juvenile tuberculosis which is a definite entity. This disease is characterized by a history of fatigue; the patients are usually languid, listless, have a poor appetite, and are irritable. They have been exposed to active tuberculosis, are undernourished, have a moderate temperature elevation, and positive tuberculin tests. If any organ in the child is found to be definitely infected with tuberculosis, the disease is no longer masked, and is classified as an active tuberculosis of the organ involved. In the presence of other foci of infection such as infected tonsils, teeth, and sinuses, a diagnosis of suspected juvenile tuberculosis can be made if the patient presents the picture described as masked juvenile tuberculosis, since one can not determine to what extent the infected foci are responsible for the symptoms.

3. (With R. W. Morse.) Bronchiectasis in Children. *American Journal of Diseases of Children*, 29:286-87. 1925.

This report covers fifteen cases of bronchiectasis, which were discovered in the routine examination of 2,000 patients at the Lymanhurst School and out-patient clinic. In 7 patients the history dated back for more than four years. The outstanding complaint was cough, usually not severe but aggravated by acute catarrhal attacks, which were quite frequent in 7 cases. Expectoration was present in 13, profuse in 5, but only 1 complained of foul sputum. The temperature varied from 99 to 101° F. One complained of night sweats; only 4 tired easily. Of the entire group 70 per cent were undernourished. The Pirquet test was positive in 3, the D'Espine sign in 5 patients; 4 had infected tonsils, 5 had dental caries and abscesses, and 1 had an infected maxillary sinus. Three had clubbing of the fingers. The factors concerned in differential diagnosis are considered.

4. See also the study listed under J. G. Rockwell (College of Education, Department of Educational Psychology).

LAWRENCE F. RICHDORF, M.D., Ph.D. in Pediatrics, Instructor in Pediatrics.

1. A Quantitative Study of the Growth of the Normal Infant in the First Year. (Thesis for the Ph.D. degree, under the direction of R. E. Scammon; see abstract under the Department of Anatomy.)

2. (With F. W. Schlutz.) Diabetes. Preliminary report: The Care and Treatment of Juvenile Diabetes.

3. Work in collaboration with students now in progress:

(1) Joseph T. Delougherty. The neonatal period.

(2) Gilbert Leonard. Correlation of diets in normal child (from different universities).

(3) William H. Griffith. Acute infectious polyarthrititis in the newborn.

(4) M. Duryea. Relationship between maternal infections and feeding disturbances in the newborn in the first two weeks.

(5) O. E. Benell. A case of severe ulcerative stomatitis.

(6) E. Tessum. Behaviour disturbances in sick children at the University Hospital.

4. See also the study listed under J. G. Rockwell (College of Education, Department of Educational Psychology).

## PHARMACOLOGY AND THERAPEUTICS

ARTHUR D. HIRSCHFELDER, B.S., M.D., Professor of Pharmacology and Director of the Department of Pharmacology.

1. (With R. N. Bieter.) Further Studies on the Excretion of Dyes in the Frog's Kidney. *Journal of Pharmacology and Experimental Therapeutics*. 25:165. 1925.

In the frog's kidney there is a free anastomosis between the branches of the renal artery and those of the renal portal vein and it is possible to watch the merging of the two blood streams in the same vessel. Ligation of the renal portal vein does not diminish the excretion of phenolsulphonephthalein or of sodium sulphindigotate. After ligation of the renal portal vein the blood stream in the venules surrounding the kidney tubules is pulsating. If the renal arteries are ligated no phenolsulphonephthalein is excreted even though the blood to the kidneys is oxygenated by placing the frog in an atmosphere of oxygen. All these facts point to the glomeruli as the site of excretion of phenolsulphonephthalein and sodium indigosulphonate in spite of the fact that the tubule cells are seen to absorb considerable amounts of these dyes.

Further investigations are in progress upon the rôle of glomeruli and the tubules in the excretion of phenolsulphonephthalein in the kidneys of the frog. The experiments performed thus far indicate (1) that there is a free anastomosis between the branches of the renal arteries and renal portal veins in the frog's kidney; (2) that phenolsulphonephthalein and sodium sulphindigotate are excreted by the glomeruli; (3) that, though these dyes are absorbed or adsorbed by the cells of the renal tubules they are excreted chiefly or entirely by the glomeruli.

2. Studies upon the Vascular and Capillary Phenomena and Supposed Axon Reflexes Concerned in the Development of the Oedema in Mustard Oil Conjunctivitis, Together with the Effects of Vasodilator Drugs, Local Anesthetics, and Vital Stains. *American Journal of Physiology*, 70:507. 1924.

The oedema fluid exuding in mustard oil conjunctivitis has a slightly alkaline reaction close to that of the blood (just pink to cresol red). The development of the oedema is a phenomenon of filtration across the walls of injured blood vessels, and is dependent upon the filtration pressure in the arterioles. It is not due to imbibition of water by the colloids. It is not inhibited by local anesthetics as claimed by Vivian Bruce nor by calcium chloride unless these substances cause an intense vasoconstriction.



Inhibition of mustard oil oedema is not due to axone reflexes. Trypan blue intravenously stains the injured area selectively whether oedema is present or not.

3. (With J. P. Quigley.) A Comparison of the Action of Some Secondary and Tertiary Aromatic Alcohols with Special Reference to Local Anesthesia. *Journal of Pharmacology and Experimental Therapeutics*, 24:405. 1924.

The authors have shown upon a number of primary, secondary, and tertiary aromatic alcohols that while primary alcohols have a local anesthetic action this effect is much less with the secondary alcohols, and the tertiary alcohols do not show it at all unless a phenolic hydroxyl is present. All these substances lower blood pressure and relax smooth muscle.

4. (With H. H. Jensen.) Studies upon the Local Anesthetic and Antispasmodic Action of Some Ethers and Esters of Saligenin. *Journal of Pharmacology and Experimental Therapeutics*, 24:423. 1925.

The authors have investigated a series of esters and ethers of saligenin. All these substances have some local anesthetic action; all lower blood pressure and cause relaxation of smooth muscle, but they all are too irritating for use in clinical medicine.

5. (With Irma Backe and Janette Jennison.) The Rôle of Epinephrine on the Production of Oedema by Local Anesthetics. *Journal of Pharmacology and Experimental Therapeutics*, 24:453. 1925.

When epinephrine is added to the local anesthetics, cocaine and saligenin, it increases the irritant action of the latter upon the tissues, as shown by the tendency of the mixture to produce a wheal of oedema in the subcutaneous tissue of the rabbit's ear. The addition of epinephrine to procain (novocain) and to butyn does not cause an increased tendency to produce oedema.

6. (With H. C. Maxwell.) Effect of Insulin in Experimental Intoxication with Alcohol and Acetone. *American Journal of Physiology*, 1924.

Insulin does not prevent or diminish alcohol or acetone intoxication of rabbits; nor does the injection of alcohol stop insulin convulsions. The authors have also investigated the action of extracts of *szyszigium jambulanum* (jambul) upon the blood sugar in rabbits. No change in blood sugar was obtained with extracts of jambul obtained from several different sources.

7. (With R. L. Gregory.) Blood Pressure Records from the Abdominal Aorta. *Journal of Pharmacology and Experimental Therapeutics*, 25:170. 1925.

The technique of obtaining blood pressure tracings from the abdominal aorta of rabbits suitable for class work operation is easy. Pulsations of two millimeters amplitude are easily obtained with a mercury manometer. The construction of a simple membrane manometer is described, with which it is easy to obtain pulse tracings having an amplitude of fifteen millimeters.

8. (With Charles Cervenka.) The Effect of Quinidine on Interauricular Conduction and Irritability in the Terrapin's Heart. *Proceedings of the Society for Experimental Biology and Medicine*, 22:311-12. 1925.

When the contractions of the right and left auricles of turtles were registered, and rhythmic electric stimuli thrown into the right auricle, it was found that quinidine

diminished the irritability of the auricular muscle to a much greater degree than it diminished the conduction of impulses from right auricle to left auricle. This would seem to indicate that in clinical auricular fibrillation, the drug acts by suppressing the genesis of abnormal impulses rather than by diminishing the conduction of circus impulses.

9. (With Carl H. Rice.) The Effects of Excitement on the Action of a Soporific Drug (Sodium Barbitol). *Journal of Pharmacology and Experimental Therapeutics*, 24:429. 1925.

Sodium barbitol in varying doses was administered to a series of rats until the minimal soporific dose was found. At a later date these rats again received the same dose but were subjected simultaneously to mental excitement (fear) caused by placing them in a large cage with a rabbit. When thus excited the rats did not go to sleep under the influence of the drug, but remained awake and tried to escape by climbing up the sides of the cage. Even when doses large enough to cause great muscular inco-ordination were given, the excited rats remained conscious. With large doses some stupor and inco-ordination set in, but no true sleep. These experiments show the importance of securing mental quiet in a patient before administering a soporific drug.

10. (With C. W. Bunker.) Studies on Mosquito Repellent Substances. *American Journal of Tropical Diseases*. (In press.)

A systematic comparative study was made of a large series of aliphatic and aromatic hydrocarbons, aldehydes, alcohols, ethers, and ester. The substance was spread upon one forearm of a human subject exposed to the bites of mosquitos. The other arm (untreated) was kept as control; and the number of mosquitos alighting and biting on each arm during a given period of exposure was noted. No constant relation of repellent action to either the chemical group or the boiling point of the substance could be noted. Citronellol, citronellal, and geraniol were found to possess the greatest repellent action of the substances studied.

The repellent action of less volatile synthetic derivations of citronellol, etc. are now being studied in collaboration with Dr. M. A. Barber, of the U. S. Public Health Service, and Professor Emmet Reid, of the Johns Hopkins University.

11. (With R. L. Gregory.) New Catechol Derivatives.

The authors have synthesized a number of new catechol derivations related to epinephrine, and are investigating their action upon the blood pressure, smooth muscles, and bronchi.

12. Relation between the Physicochemical Properties and the Physiological and Antiseptic Actions of a Series of Drugs and Antiseptics. (Work in progress.)

EDWARD D. BROWN, Phm.D., M.D., Associate Professor of Pharmacology.

(With D. E. Morehead.) Experiments on the Toxicity of Acetanilid and Caffeine on the Frog's Heart. *Journal of Pharmacology and Experimental Therapeutics*, 25:161. 1925.

Experiments have been made to determine whether caffeine increases the toxicity of acetanilid, which has been generally accepted since the publication of the work done by Hale in *Hygienic Laboratory*, Bulletin No. 53. From the results obtained in our experiments, using the same methods employed by Hale, it was found that caffeine had little or no effect as regards altering the toxicity. It was found that the increased toxicity found by Hale was due to the use of citrated caffeine, the citric acid present in the compound being responsible for his results instead of the caffeine.

## PHYSIOLOGY AND PHYSIOLOGICAL CHEMISTRY

JESSE F. McCLENDON, Ph.D., Professor of Physiological Chemistry.

1. The Electric Conductivity of Blood Corpuscles to Currents of Varying Frequency.

Apparatus was built for varying the frequency from zero to a million cycles and it was found that the conductivity increased directly with the frequency of the determination of iodine in foodstuffs. A new apparatus for preventing iodine loss in analysis was made.

2. See also the studies by J. B. Hathaway and A. G. Mulder.

FREDERICK H. SCOTT, Ph.D., M.B., D.Sc., Professor of Physiology.

1. (With Maurice Visscher and Alice Rupp.) On the Cause of the Respiratory Wave in Arterial Blood Pressure.

It was shown that this is due to the altered inflow into the heart in inspiration and expiration. It takes approximately three heart beats for altered inflow into the right side of the heart to be felt on arterial pressure. Some of the results have already been published in the *American Journal of Physiology*, 70:586.

2. Factors Influencing the Interchange of Fluid between Blood and Tissues.

The influence of pituitrin, adrenalin, histamin, and other factors altering the interchange is being investigated. The results so far obtained would seem to indicate that these substances exert their influence on the capillary wall and not on the tissues themselves.

3. See also the studies by M. M. Loucks, A. M. Rupp, H. P. Skelton, and M. Visscher.

HAROLD J. LEONARD, B.A., D.D.S., Associate Professor of Oral Hygiene and Pathology.

The Relation of Calcium Metabolism to Dental Disease. (To be offered as a thesis for the M.S. degree; under the direction of C. J. V. Pettibone.)

The purpose is to determine so far as possible the causes of susceptibility to dental caries and to dental periclasia. The theory based on clinical and some laboratory evidence is that susceptibility to dental caries is due to a lack of protective factors in the saliva. This lack is due to faulty diet, the chief fault of which is that it fails to provide either a sufficiency of calcium or the accessory factors which promote its metabolism. The aim of this phase of the problem is to determine the truth or falsity of this theory. The other phase of the problem would determine if possible the relation of calcium metabolism to the resistance of the periodontal tissues to infection and destruction. Calcium analysis of ionic and combined calcium in blood and saliva on a series of patients exhibiting the various mouth conditions will be run. Possibly also an analysis of food and excretion for calcium will be necessary for further determinations.

GRACE MEDES, Ph.D., Assistant Professor of Physiological Chemistry.

#### Magnesium Metabolism in Rats.

Diets are being fed in which the ratios of magnesium, phosphorus, and calcium are varied and the effect on the ratios of these three elements in the rats is determined.

The concentrations of these elements in the food, in the excreta, and in the ash of the rat are determined.

JOSEPH B. HATHAWAY, B.S., Assistant in Physiological Chemistry.

The Determination and Distribution of Iodine in Relation to the Prevalence of Goiter. (Under the direction of J. F. McClendon.)

This survey was continued for Utah, parts of California, and other places and a positive correlation observed. The goiter data were collected by state departments of public health. An improvement in the analytical procedure was tested.

MILO M. LOUCKS, M.S., Fellow in Physiology.

The Rôle of Calcium in the Coagulation of Blood. (Thesis for the M.S. degree; F. H. Scott, Adviser.)

Calcium is found to be essential for both phases of coagulation. Fibrin contains varying amounts of calcium, so it can not be merely looked upon as a calcium compound.

ARTHUR G. MULDER, B.A., Shevlin Fellow in Medicine.

1. Fluorine Metabolism. (Under the direction of J. F. McClendon.)

A method for micro-analysis of fluorine has been developed and the intake and storage of fluorine in rats determined, together with its effect on tooth structure.

2. See also the study with Maurice Visscher.

ALICE M. RUPP, Ph.D., Fellow in Physiology.

The Metabolism in Muscle Tonus. (Thesis for the Ph.D. degree; F. H. Scott, Adviser.)

Various means of studying metabolism were used, such as, oxygen use, carbon dioxide production, and heat production. No relation between the amount of tonus and these factors could be found.

HAROLD P. SKELTON, B.A., M.S., Assistant in Physiology.

The Storage of Water by Various Tissues of the Body. (Thesis for the M.S. degree; F. H. Scott, Adviser.)

A study of the interchange between the blood and the various tissues under the influence of hemorrhage, intravenous injection of various salt solutions, etc. It is shown that the skin and muscles are the chief organs concerned in this interchange.

MAURICE VISSCHER, Ph.D., Fellow in Physiology.

1. The Transportation and Storage of Carbohydrate in the Animal Body. (Thesis for the Ph.D. degree; F. H. Scott, Adviser.)

The results are of significance in connection with the regulation of the blood sugar level and indicate the importance of the hydrogen ion in this process. A systematic physicochemical study was made of the glucose-glycogen reaction.

2. (With A. G. Mulder.) The Chemical Nature of the Carbohydrate in the Blood.

3. (With R. G. Green.) The Effect of Insulin upon the Body Temperature. *American Journal of Physiology*, 71:502. 1925.

After insulin a fall in temperature was most frequently observed.



## PREVENTIVE MEDICINE AND PUBLIC HEALTH

HAROLD S. DIEHL, M.A., M.D., Assistant Professor of Preventive Medicine and Public Health and Chief of the Department of Preventive Medicine and Public Health.

1. (With K. H. Sutherland.) Systolic Blood Pressures in Young Men, Including a Special Study of Those with Hypertension. To be published in the *Archives of Internal Medicine*.

The group studied consisted of 5,122 young men who entered the University of Minnesota during the years 1922, 1923, and 1924. Blood pressure readings were taken of each student at entrance to the University and repeated subsequent readings were taken on all who showed systolic pressures of 140 millimeters or more on the first examination. A careful physical examination was made of every student.

The calculated percentage of the entire group who showed secondary hypertension was 1.2 per cent; transient hypertension, 5.4 per cent; intermittent hypertension, 2.8 per cent; and persistent hypertension 1.6 per cent. Only 15 per cent of the 209 who were re-examined showed persistent hypertension. Nervousness and excitement seem to be the most important factors in the production of transient hypertension in young persons. There seems to be some relationship between overweight and hypertension, but none between vital capacity and hypertension.

2. Observations on the Value of Chlorine in the Treatment of Acute Respiratory Infections. To be published in the *Journal of the American Medical Association*.

An apparatus, similar to the one used by Colonel E. B. Vedder, was installed and chlorine treatments were given to university students. All students treated with chlorine were first examined by a physician and notes on the type of cold were made. Approximately, alternate students with acute colds were given chlorine treatments, the others being studied as a control series. The series treated with chlorine contained 425 students and the control series 392.

In this study we found some benefit from the chlorine treatment in the per cent of cures within one day after treatment: 19.5 per cent of chlorine series recovered in one day as compared to 12.5 per cent of the control series. The best results were obtained in the treatment of rhinitis, of these 23.6 per cent recovered in one day with chlorine as compared to 6.7 per cent in the control series. However, the per cent of recoveries within three days after reporting to the Health Service was almost the same in the control series as in the series that had chlorine treatment.

3. Relation of Humidity to Acute Respiratory Infections.

The purpose of this study is to determine whether there is any relationship between the humidity in Minneapolis and the incidence of acute respiratory infections among the students of the University of Minnesota. The study covers the school years 1923-24 and 1924-25. For each day of these years the morbidity rate of acute respiratory infections is being computed and plotted as a curve. On the same sheet another curve is being plotted showing the humidity on each day, this data being obtained from the U. S. Weather Bureau. The work is not yet completed so no conclusions can be drawn, but so far it seems doubtful whether the curve of acute respiratory infections will show any definite relationship to the humidity curve.

4. (With Marie Connelly.) Relationship of Exposure to Acute Respiratory Infection.

This study was undertaken with the hope of getting some information as to whether acute respiratory infections are more common among the persons who are more frequently exposed. Dr. Turnacliif, medical director of the Minneapolis Street Railway Company, very kindly made his records available to us for this study. Data are being

compiled which will show the incidence of acute respiratory infection among motormen and among conductors. During the time that they are on duty the motormen are isolated in the front of the car while the conductors are constantly exposed to the passengers. It will be interesting to note whether colds are more frequent in the one group than in the other.

### 5. Immunity to Diphtheria in Minnesota.

The study was undertaken for the purpose of determining what per cent of young adults in Minnesota are immune to diphtheria. Park reports that in New York City 80 per cent of persons twenty years of age and above are immune to diphtheria. The method utilized was to do Schick tests on the students who entered the University of Minnesota in the fall of 1923 and the fall of 1924, a total of about 4,000. These tests were read and the results are being analyzed according to sex, age, and size of home community. The analysis of the data has not been completed but the results seem to indicate that only about 60 per cent of those tested show an immunity.

### 6. The Occurrence and Significance of Albuminuria in Young Adults.

The purpose of this study is to determine how frequently albuminuria occurs in university students and, when it does occur, how often it is without significance and how often an indication of disease. Urinalysis is a part of the physical examination required of every student entering the University of Minnesota. All those in the past five years whose urine showed albumin on entrance examination have been asked to report to the Students' Health Service later for thorough study and most of them have done so. The results of these examinations have been carefully recorded and now are being analyzed. No conclusions have yet been reached.

### 7. See also the study with L. M. Mayer.

JAY A. MYERS, Ph.D., M.D., Assistant Professor of Preventive Medicine and Public Health.

### 1. A Study of the Clinical Findings and Ring Test in 500 Cases Examined for Tuberculosis. *American Review of Tuberculosis*, 11:71-77. 1925.

Among 500 cases examined for tuberculosis the ring test was negative in 304 and positive in 196. Of the 304 negative ring test cases the clinical findings, as far as active tuberculosis is concerned, were in complete agreement with the test in 276. Six of the remaining cases had far advanced disease and were apparently near death. Fourteen other cases with positive ring tests in the presence of acute bronchitis became negative after the bronchitis disappeared. Five other patients with tubercle bacilli in the sputum had good working capacity and were free from symptoms. In only the following 6 cases is there no explanation to offer for the apparent discrepancy. One of these was a case with a tuberculous kidney confirmed by pathological examination after nephrectomy. The remaining 5 cases have moderately advanced disease with slight or no symptoms.

### 2. (With C. O. Rollie.) The Incidence of Pleurisy in 2,000 Children Examined for Tuberculosis. *American Review of Tuberculosis*. (In press.)

Our work consists of a report of the cases giving histories of pleurisy together with those in whom definite evidence of pleurisy was found among 2,000 children examined for tuberculosis in the out-patient department of the Lymanhurst School for Tuberculous Children. From physical and X-ray examination 61 of our entire group of 2,000 cases showed definite evidence of pleurisy. In 7 of our 61 cases there was evidence of enlargement or calcification of the hilum nodes on the side of the pleural lesion, in 32 cases there was such evidence on both sides, while in 7 cases it was found only on the opposite side. In 15 cases there was no X-ray evidence of calcification or enlargement of the hilum nodes. The incidence according to age is also considered.

3. (With Kuen Tsiang.) Studies on Tuberculosis in Infancy and Childhood. D'Espine's Sign and Stereoscopic Roentgenograms in the Detection of Enlarged Hilum Lymph Nodes in a Group of Children Examined for Tuberculosis. *American Review of Tuberculosis*. (In press.)

Our group of cases consists of 1,057 children examined in the out-patient department of the Lymanhurst School for Tuberculous Children. Of this entire group 311 showed the presence of D'Espine's sign, 211 of which presented X-ray evidence of hilum enlargement or calcification or both. The remaining 100 with D'Espine's sign present showed no evidence of hilum node enlargement or calcification by X-ray examination. The remaining 746 children in our group presented X-ray evidence of slight or moderate enlargement or calcification or both of the hilum nodes but D'Espine's sign was absent.

D'Espine's sign was rarely present in children under five years of age. This may be due to the small number of cases examined in that period of life. From six to thirteen years of age, the positive sign cases rapidly increased. We are convinced that D'Espine's sign even when present is not diagnostic of tuberculosis. On the other hand, a negative D'Espine's sign does not exclude tuberculosis.

4. (With Estella Magiera.) The Relation of Exposure to Infection in 2,000 Children Examined for Tuberculosis. *American Review of Tuberculosis*. (In press.)

Our data were taken from records of the out-patient department of the Lymanhurst School for Tuberculous Children. In all, 2,000 children were examined. Of this number 1,033 were girls and 967 were boys. They ranged in age from a few months to nineteen years. Of the girls examined 440 were positive to the von Pirquet test while 393 boys gave positive reactions.

In grouping our cases according to exposure we found 761 giving histories of intimate contact with definitely tuberculous patients, another group of 784 with no knowledge of ever having come in contact with a tuberculous patient and a third group of 455 whose histories were questionable—that is, not enough evidence could be gathered to warrant a definite statement. The von Pirquet tests were positive in 435 of the 761 cases with definite histories of exposure, in 224 of the 784 with no histories, and in 174 of the 455 cases with questionable histories of exposure. It is obvious, therefore, that the incidence of tuberculous infection is definitely higher among those children with histories of exposure than among the other two groups.

5. (With E. O. Lodmell.) The Detection of the Primary Lesion in a Group of Children Examined for Tuberculosis. *American Review of Tuberculosis*. (In press.)

In this report we have included 1,412 patients examined in the out-patient department of the Lymanhurst School for Tuberculous Children, all of these children had stereoscopic X-ray plates, histories, physical examinations, etc. Of these 1,412 cases, 232 showed shadows in the lungs which the roentgenologists interpreted as primary foci of tuberculosis. Among our 232 children showing evidence of primary foci by the X-ray, 152 gave definite histories of exposure. The remainder gave questionable or no histories of exposure. There were among these 232 children 145 who reacted positively to the von Pirquet test. Since approximately 45 per cent of our 1,412 cases reacted positively to the von Pirquet test, and only 232 presented X-ray evidence of primary foci in the lung parenchyma, it would appear that many primary foci develop elsewhere.

6. (With C. H. Rice.) Studies on the Respiratory Organs in Health and Disease. XVIII. The Vital Capacity of the Lungs in Chronic Fibrous

Pleurisy, Healed Empyema, and Pulmonary Tuberculosis, both Clinical and Non-clinical. *Archives of Internal Medicine*. (In press.)

The vital capacity percentages were taken from tables prepared from Dreyer's weight formulae and West's surface area method. Of 773 cases in this study grouped according to symptoms and physical signs the average vital capacity of those found to be negative was 102.4 per cent of the normal, while in those with definite pulmonary tuberculosis the averages ranged from 90 per cent to 42.6 per cent depending upon the stage of the disease and symptoms present. Of 717 cases grouped according to X-ray findings the average vital capacity of those entirely negative was 104.1 per cent of the normal. It was of interest and we feel of considerable practical value to find that those cases with slight X-ray findings but with no evidence of clinical disease have vital capacities well within normal limits. When clinical diseases exists the vital capacity was found in most cases to decrease as the extent of disease revealed by the X-ray increased.

7. Opportunities for Nurses in Tuberculosis Work. *American Journal of Nursing*. (In press.)

Recently a questionnaire was sent to each institution for the tuberculous listed in the latest directory issued by the National Tuberculosis Association. The data from the replies received have been tabulated as follows: Number of sanatoria replying to questionnaire, 338; total patient capacity of sanatoria replying to questionnaire, 53,338; total number of nurses employed in sanatoria replying to questionnaire, 4,428; total number of nurses who had had public health training, 305; number of sanatoria operating nurses' training schools, 42; number of sanatoria offering tuberculosis training to nurses in training in general hospitals, 27; number of nurses annually receiving such training, 311; average monthly salary of supervisors of nursing in sanatoria, \$124.71; average monthly salary of head nurses in sanatoria, \$95.51; average monthly salary of other graduate nurses in sanatoria, \$85.13; average monthly salary of practical nurses in sanatoria, \$59.84.

8. (With William Bailey.) Studies on the Respiratory Organs in Health and Disease. XX. The Value of the Vital Capacity Test in Artificial Pneumothorax Treatment. *American Review of Tuberculosis*, 10:597-605. 1925.

The report includes 2 cases of complete spontaneous collapse, 3 cases of partial spontaneous collapse, 8 cases of artificial collapse on which only one reading was secured, and 11 cases of artificial collapse on which several readings have been taken before and after artificial pneumothorax treatments, and 4 cases on which readings have been taken routinely before and after each treatment since beginning artificial pneumothorax. This report also includes two cases on which extrapleural thoracoplasty had been done. The vital capacity taken before the initial injection of air may be found of great value in determining the amount of air which can safely be injected. We have also felt that routine vital capacity readings are valuable in determining the condition of the better lung. In cases with one lung well collapsed we have found that the readings after injection of air sufficient to bring the manometer reading to zero were quite constant from time to time.

9. Studies on the Respiratory Organs in Health and Disease. XIX. The Significance of Serial Vital Capacity Readings in the Guidance of Diagnosis and Treatment of Certain Diseases of the Chest. *American Review of Tuberculosis*, 11:64-70. 1925.

The vital capacity of the lungs is a valuable criterion of good health. It is easily determined, and is remarkably constant from year to year in adults before the



age of forty-five, except in the presence of disease involving directly or indirectly the heart or lungs. Therefore, if one's actual vital capacity is known it may serve as an excellent standard of judging the condition of these organs from time to time. If the vital capacity of the lungs of growing children decreases or even remains constant in the presence of definite increase in body size, the evidence is sufficient to warrant most careful examination and subsequent observation for disease of the lungs or heart. Cases are cited to show that the vital capacity test is of tremendous value both in diagnosis and the guidance of treatment when serial readings are made.

10. (With L. H. Cady.) Studies on the Respiratory Organs in Health and Disease. XVII. The Vital Capacity in 347 Cases of Disease of the Bronchi. *Journal-Lancet*, 46:66-67. 1925.

A comparison between the available normal standards and 347 readings of vital capacity in patients with a clinical diagnosis of acute or chronic bronchitis, peribronchial infiltration and asthma. The conclusion is that no significant reduction of the vital capacity of the lungs occurs in bronchitis. In 17 cases of bronchial asthma the average reading is 87 per cent of the normal.

11. (With W. P. Shepard.) The Respiratory Organs in Health and in Disease. XVI. A Comparison of Vital Capacity Standards in 3,534 Male University Students. *Archives of Internal Medicine*, 35:337-46. 1925.

During the fall entrance examinations of the last three years at the University of Minnesota, the Students' Health Service has paid particular attention to vital capacity measurements. The complete records of 3,534 male students were available for study. The records were analyzed with a view of selecting those men in whom no physical defect having a possible bearing on vital capacity could be detected, and those having no past history of pulmonary or cardiac disease. This left only 1,641 who were considered normal.

When applied to these 1,641 carefully selected students, the commonly used standards for estimating vital capacity from surface area, height, and weight practically coincide. The estimation based on chest circumference gives readings considerably too low, while that based on sitting height gives readings too high. When applied to this selected group, all standards give readings too high for a normal distribution. Great care should be used in selecting normals for purposes of working out standards for the estimation of normal vital capacity.

12. (With W. P. Shepard.) Studies on the Respiratory Organs in Health and Disease. XV. Tuberculosis and Other Respiratory Infections among University Students. *Minnesota Medicine*, 8:237-42. 1925.

In the fall of 1920 a special clinic was opened at the University of Minnesota Health Service for the diagnosis and treatment of tuberculosis and diseases of the lower respiratory tract among university students. The present paper is a brief report of the accomplishments of this clinic during the first four years of its existence when approximately 800 students were examined.

The following classification of cases has been made: Diagnosis unwarranted, 26; entirely negative, 198; acute upper respiratory inspection, 13; acute bronchitis, 200; chronic bronchitis, 53; bronchiectasis, 5; bronchial asthma, 11; acute fibrinous pleurisy, 30; idiopathic pleurisy with effusion, 4; suppurative pleurisy, 10; chronic fibrous pleurisy, 23; spontaneous pneumothorax, 1; tuberculous cervical adenitis, 5; tuberculosis of the bone, 1; tuberculosis of the soft palate, 1; tuberculosis of the kidneys, 2; tuberculosis of the peritoneum, 1; peribronchial infiltration, 11; peribronchial tuberculosis, 53; demonstrable non-clinical pulmonary tuberculosis, 58; arrested pulmonary tuberculosis, 28; apparently arrested pulmonary tuberculosis, 14; quiescent pulmonary tuberculosis, 23; active pulmonary tuberculosis, 32; total, 803.

13. (With L. M. A. Maeder.) Studies on the Respiratory Organs in

Health and Disease. XIV. The Vital Capacity of the Lungs of 419 Firemen. *Archives of Internal Medicine*, 35:184-203. 1925.

The vital capacity of 419 Minneapolis firemen was secured in the present study. Of this number, 345 had been in the service of the Fire Department for a period of time ranging from three months to thirty-nine years and the remaining 74 were substitutes. Empiric formulas were developed, giving the vital capacity according to body length, body weight, age, or length of service.

14. (With C. O. Rollie.) The Incidence of Chronic Pulmonary Lesions in a Group of Children Examined for Tuberculosis. *American Review of Tuberculosis*. (In press.)

Among 2,000 children examined in the out-patient department of the Lymanhurst School for Tuberculous Children there was a group with definite evidence of diseases of the bronchi. Thirty cases showed definite evidence of pulmonary involvement. Of these, 6 were due to pneumonia. The remaining 24 cases were considered tuberculous although we were not able to demonstrate tubercle bacilli in all cases. Of these 24 children, the lesions were located in the left upper lobe in 8, in the right upper lobe in 12, and in both upper lobes in 4. In only 4 cases was there evidence of cavity formation. The incidence according to age and sex is also considered.

15. (With William Bailey.) The Vital Capacity of the Lungs in a Group of Sanatorium Patients. *Journal-Lancet*, 45:140-41. 1925.

The observations were made at the Parkview Sanatorium on all of the 95 patients resident at that time. Of all patients examined, 43 were in the far advanced stage. Their average vital lung capacity was found to be 45 per cent of the theoretical normal. In the moderately advanced stage there were 35 patients with an average vital capacity of 57 per cent of the theoretical normal. There were only 17 patients with minimal disease, and their average vital capacity was found to be 60 per cent of the theoretical normal. It is obvious, therefore, that clinical tuberculosis requiring sanatorium treatment very definitely decreases vital lung capacity.

16. Vital Capacity of the Lungs. A Handbook for Clinicians and Others Interested in the Examination of the Heart and Lungs Both in Health and Disease, with an Introduction by S. Marx White. Baltimore: Williams and Wilkins Company. 1925. 140 pages.

This is an attempt to bring together the results of the work on vital capacity carried on not only at this University but also in other parts of the world. The titles of the various chapters are as follows: I. The History of the Study of Vital Capacity; II. Factors Other than Disease Which Influence the Normal Vital Capacity; III. The Influence of Disease upon the Vital Capacity; IV. Some Limitations and Uses of the Vital Capacity Test; V. Measurements and Instruments Used in the Vital Capacity Test; VI. Normal Vital Capacity Standards; VII. Bibliography.

17. (With Kuen Tsiang.) The Relation of Tuberculous Infection to Calcification of the Hilum Lymph Nodes. *American Review of Tuberculosis*. (In press.)

The material consists of 1,432 cases examined in the out-patient department of the Lymanhurst School for Tuberculous Children. In 408 of these cases the stereoscopic plates revealed no evidence of calcifications, while in the remaining 1,024 cases there were findings which the roentgenologists interpreted as areas of calcification in the hilum lymph nodes. Of these 1,024 cases 70 per cent presented evidence of only slight calcification; 29 per cent presented evidence of a moderate amount of calcification, while only 1 per cent showed evidence of marked calcification. Of the total number showing evidence of calcification of the hilum nodes, 45 per cent reacted positively to the von Pirquet test.

HAROLD A. WHITTAKER, B.A., Assistant Professor of Public Health and Preventive Medicine, and Director of the Division of Sanitation, Minnesota State Board of Health.

1. (With R. W. Archibald, L. Shere, and C. E. Clement.) The Effect of Various Factors on the Creaming Ability of Market Milk. *United States Department of Agriculture in Co-operation with the Minnesota State Board of Health, Department Bulletin No. 1344.* 1925.

These studies are directed especially toward a determination of the effect of the different steps in the processing of milk at pasteurization plants. Investigations were conducted at a large number of commercial pasteurization plants using various kinds of apparatus. Laboratory experiments were also undertaken to obtain certain fundamental information. The results of the investigations showed that the factors affecting the creaming ability of milk include the age of the milk, re-creaming, clarification, rapidity of cooling, degree of temperature to which it is cooled, etc. It was concluded that, in general, a decrease in the cream volume of the finished product from a pasteurization plant may result from the accumulation of slight decreases brought about by various steps in the process, and that if all other steps in the process are properly controlled and the temperature of pasteurization does not exceed 146° F. for 30 minutes, the decrease in the cream volume is not sufficient to be of commercial significance.

2. (With R. W. Archibald and L. Shere.) Relative Efficiency of Methods of Sterilization of Milk Bottles at Pasteurization Plants in Minnesota. *Public Health Reports*, Reprint No. 918. 1924.

These investigations were undertaken for the purpose of obtaining definite information on the results secured on the methods of sterilization of milk bottles used at pasteurization plants throughout the state. The investigations showed that the chlorine solution as compared with apparatus using steam was more dependable as applied in routine practice at the plants under observation. This was especially evident at the smaller pasteurization plants where manually operated apparatus was used. Steam when properly applied with the automatic machines gave satisfactory results but it was observed that in most instances the operators neglected to carry out certain details that were necessary to accomplish effective sterilization.

3. (With R. W. Archibald.) An Apparatus for Sterilizing Milk Bottles at Small Milk Plants and Dairies. *Bulletin of the Minnesota State Board of Health, Division of Sanitation*, August, 1924.

Previous investigations had shown that calcium hypochlorite (chloride of lime) could be used as an effective agent in sterilizing milk bottles. It was found that in order to sterilize bottles effectively by means of chemical disinfectants, it was necessary to use an apparatus which would insure the exposure of the entire surface of the bottles to the chemical. A simple apparatus was designed for this purpose which could be placed in the rinsing water compartment of the ordinary type of wash tank used at small milk plants and dairies. The results obtained with this apparatus using calcium hypochlorite as a disinfectant were found to be very satisfactory for the sterilization of milk bottles.

4. Some Specific Factors Responsible for Pollution or Affecting Analyses of Water Supplies. *Public Health Reports*, Reprint No. 972. November, 1924.

This material includes an enumeration of a large number of factors responsible for the pollution or affecting the analysis of water supplies that have come under the observation of the Division of Sanitation in its routine work on water supplies throughout the state. A study of these factors shows the importance of thorough field investigation work on water supplies in order to determine their safety for drinking purposes.

5. (With J. A. Childs and L. Shere.) An Investigation of the Effect of Chlorine, Industrial Wastes, and Sewage on Fish Life.

These investigations are being undertaken in co-operation with the Division of Sanitation, Minnesota State Board of Health, and are being undertaken in co-operation with the State Game and Fish Department. These studies are being made for the purpose of collecting fundamental information on this subject as an aid in making proper interpretations of stream pollution problems as regards fish and other aquatic life. Work in progress.

6. (With J. A. Childs and E. M. Wade.) Studies on the Effect of Imhoff Tank and Chlorine Treatment on Sewage Containing Tubercle Bacilli from a Tuberculosis Sanatorium.

These investigations are being undertaken in co-operation with the Division of Preventable Diseases of the State Board of Health, and are being made for the purpose of determining the treatment necessary for sewage from sanatoria housing tuberculous patients.

7. (With J. A. Childs and O. E. Brownell.) Investigations on Swimming Pools, Especially in Relation to the Permissible Loading of Such Pools.

Studies are being made on a number of pools in various sections of the state where different types of equipment are used for the recirculation and sterilization of the water. Basic studies have already been conducted on the amount of bacterial contamination contributed by a given number of bathers including groups that have been thoroughly cleansed before entering the pool and other groups where no precautions have been made to remove bacterial contamination before the bathers entered the pool.

8. (With J. A. Childs, O. E. Brownell, and L. Shere.) Studies on the Presence of High Bacterial Counts in Certain Water Supplies After Chlorination.

The purpose of this work is to determine the cause of excessive high bacterial counts in the distribution systems of the few municipal water supplies where high counts have been observed after the water has been subjected to filtration and subsequent chlorination. An effort is being made to determine the type, or types, of organisms associated with this condition, and also to test their resistance to chlorination. Previous investigations on this subject seem to indicate that this condition was due to a few spore forming organisms which were not eliminated by the treatment applied at the source but it is possible that vegetative forms of certain bacteria may also have a tolerance to chlorine. Work in progress.

9. (With R. W. Archibald.) Studies on Mechanical Defects in Milk Pasteurization Plants.

The purpose of this work is to determine the effect that certain defects identified in pasteurization plant apparatus may have on the sanitary quality of the milk treated in these plants. The work of eliminating defects has been in progress for a number of years and the more recent work has been directed especially towards a study of various types of valves and the thermostatic temperature control on pasteurization apparatus.

10. (With O. E. Brownell and L. Shere.) A Survey of the Presence of Lead in Public Water Supplies in Minnesota.

The purpose of this investigation is to determine the quantity of lead present in the distribution systems of public water supplies where lead service pipes are in use. Information has already been obtained on water supplies in about sixty municipalities. The preliminary investigation consists of allowing a uniform quantity of lead to be



exposed in a definite quantity of water for a given length of time. This indicates the activity of water in taking lead into solution. This preliminary step is followed by analysis of samples of water collected on the distribution system in localities where lead service pipes are known to be in use. The results so far indicate a surprising number of water supplies that have the ability to take lead into solution.

R. WILSON ARCHIBALD, D.V.M., Instructor in Public Health and Preventive Medicine, and Bacteriologist of the Division of Sanitation, Minnesota State Board of Health.

See four papers listed under H. A. Whittaker.

LAWRENCE H. CADY, B.A., M.D., Instructor in Preventive Medicine and Public Health, and Physician at the Students' Health Service.

1. The Vital Capacity in 347 Cases of Disease of the Bronchi. (See abstract under J. A. Myers.)

2. (With J. A. Myers.) Studies on the Normal Vital Capacity.

A statistical study of the vital capacity in 300 selected normal individuals and comparison with the available normal standards. Work in progress.

3. Studies on the Vital Capacity of the Lungs in a Random Sample of the Population: a Statistical Study of Approximately 3,000 Readings.

Comparison with available normal standards. An effort will be made to bring out a comparison between the rural and urban population represented in the data. Work in progress.

4. A Study of Pulse Rate and Blood Pressure in Relation to Physical Efficiency.

A scale proposed by Schneider is being applied to all freshmen at time of entrance to the University. The individuals having the lowest ratings are recalled for check of the original readings and an examination made of the personal family and social history. An attempt is made to correlate these findings with the physical examination.

JAMES A. CHILDS, C.E., Instructor in Public Health and Preventive Medicine, and Engineer, Division of Sanitation, Minnesota State Board of Health.

1. Investigations on the So-Called "Direct Oxidation" Process of Sewage Disposal. Report of the Division of Sanitation, Minnesota State Board of Health, 1924.

The purpose of this investigation was to determine the effectiveness of various steps in this process in the treatment of domestic sewage and certain industrial wastes. The process consists of adding lime in quantities that will produce a caustic alkalinity of from 30 to 50 parts per million. Sewage is then passed through electrolytic cells, following which it is subjected to sedimentation, and the supernatant liquid discharged as the effluent from the plant. The results of the investigations did not show that any appreciable improvement was brought about by the electrolytic treatment in addition to that accomplished by the well-known lime treatment of sewage.

2. The Practical Application of the Biochemical Oxygen-Demand Test. *Engineering Extension Department, Iowa State College, Bulletin 73, Volume 23. February, 1925.*

It was the purpose of this study to determine the applicability of this test to sewage and trade waste problems under Minnesota conditions. The test has now been used in a number of stream pollution surveys and also to test the strength of various domestic sewages and a variety of industrial wastes, including that from packing

houses, rendering plants, paper factories, creameries, and cheese factories. The results indicate that the test is practical for the study of stream pollution, sewage, and industrial waste disposal problems.

3. See also abstracts of four papers listed under H. A. Whittaker.

HARRY D. LEES, B.M., Instructor in Preventive Medicine and Public Health, and Assistant Director of the Students' Health Service.

Relation of Tuberculosis in Children to Exposure in the Home.

A study of the cases at the Lymanhurst School. Exposure to tuberculosis in the home was found in all the children who presented definite pulmonary lesions. In a large majority of the cases presenting tuberculous disease other than pulmonary, exposure in the home for varying periods was also found.

LILLIAN M. MAYER, B.S., M.D., Instructor in Preventive Medicine and Public Health, and Physician in the Students' Health Service.

1. (With H. S. Diehl.) Hypertension and Hypotension in Women Students at the University of Minnesota.

Readings in women whose blood pressures were above or below normal limits at entrance physical examinations are rechecked with a view to determining incidence, possible causes of the condition, and the results of treatment. No definite conclusions have been reached as yet.

2. The Relative Values of Various Non-Narcotic Drugs in the Treatment of Dysmenorrhea and Its Associated Vomiting.

Various drugs are prescribed for different individuals complaining of dysmenorrhea. If patient has no benefit, she uses a different prescription next time. Allonal seems the drug most effective in treatment of dysmenorrhea. The vomiting seems harder to control than the pain, and as yet no conclusions have been drawn as to the treatment of most value.

3. (With C. A. McKinlay.) The Use of Iodides in Students with Goiter.

The study aims to determine the value of iodides in reducing the size of goiters and in reducing the pulse rate in cases with tachycardia. Iodides are given over a period of several months, the circumference of the neck and the pulse rate being recorded before and after treatment. A large number of students are not given iodides, but are used as controls, neck measurements and pulse readings being taken at intervals. The study has not yet been completed.

NEIL S. DUNGAY, Ph.D., M.D., Physician in the Students' Health Service.

Hypertension.

A general study of the subject in an endeavor to determine the incidence of hypertension among young people, to gain information concerning the possible causes, and to follow the progress of selected cases for a number of years. Blood pressure readings are taken on all entering students. Those with readings above normal are called in from time to time for repeated readings. A study is being made of the medical and social histories of these students. It is hoped that observations may be made over a period of years.

## SURGERY

ARTHUR C. STRACHAUER, M.D., F.A.C.S., Professor of Surgery and Chief of the Department of Surgery.

1. Ulcers of Stomach and Duodenum.

Investigation as to the cause of ulcers of the duodenum and stomach, their inactivation and surgical removal.

2. (With M. Joannides.) Studies on the Function of the Kidney.

Investigation to determine the cause of atrophy of the human kidney after complete ligation of the ureter.

3. Congenital Hypertrophic Pyloric Stenosis.

Investigation into the etiology, pathology, and treatment of congenital stenosis of the infant stomach.

4. Cancer of the Rectum and Sigmoid.

Studies covering the growth and dissemination of cancer of the sigmoid and rectum, and the development of operative procedures for its eradication.

GILBERT J. THOMAS, M.D., Assistant Professor of Urology.

I. (With W. B. Pierce.) Ureteral Strictures.

Our purpose is to determine how often a real stricture of the ureter occurs. We have examined about 150 dead bodies and have found only one stricture. This work has not progressed far enough so that we can make any conclusions at this time.

2. (With H. S. Boquist.) Renal and Urinary Tuberculosis:

The purpose of the problem is to determine how often bilateral tuberculosis exists, to determine whether a normal kidney can excrete tubercle bacilli, and to determine whether lesions of tuberculosis heal in the kidney. We are also interested in the problem of early diagnosis of renal tuberculosis.

MINAS JOANNIDES, M.D., Instructor in Surgery.

1. (With W. A. Riley.) Echinococcus Cyst in the Scapular Area. Report of a Case. *Archives of Surgery*, 9:537-44. 1924.

2. (With W. A. Riley.) Eustrongylus Gigas: Report of a Case. (In press.)

Case reported because of its rarity, only 29 such cases being reported for this country.

3. (With W. A. Riley.) The Dog As a Carrier of Disease. Read at the meeting of the Section on Preventive and Industrial Medicine and Public Health, American Medical Association, at Atlantic City, May 25, 1925.

Laboratory observations have convinced us that the dog is a carrier of disease and dangerous to human life if not properly restrained.

4. (With C. K. Holmes.) Uretero-ureteral Anastomosis: An Experimental Study. To be published in the *Journal-Lancet*.

An experimental study of the effect of union of the two severed ends of the uréter, aiding the anastomosis by means of the ureteral catheter.

5. The Relation of the Dog to Public Health. *Minnesota Medicine*, 8:302-3. 1925.

6. Studies on the Kidney. (See abstract under A. C. Strachauer.)

7. The Effect of Sodium Citrate Injections on the Coagulation Time of the Blood.

Experimental study on the effect of sodium citrate on the coagulation time of the blood. Our conclusions are that sodium citrate solutions, either intramuscularly

or intravenously, do not decrease the coagulation time of the blood. In some cases the injections increase the coagulation time, but this is a temporary effect. Injections of calcium into the blood stream prevent toxic effects of large doses of sodium citrate. Work unpublished.

#### 8. Further Studies on Surgery of the Diaphragm.

(1) Extraperitoneal route. Description of a new route of approach both for surgery of the heart and the lower portions of the lung. Our future work with reference to this route will be with relation to surgical problems concerning the heart, the oesophagus, and the lower lobes of the lung.

(2) Physiological studies of the diaphragm, such as diaphragmatic paralysis and its relation to respiration, diaphragmatic hernia, and surgical procedures on the diaphragm itself.

#### 9. Experimental Studies on Elephantiasis.

Experimental study to determine the mechanism of production of elephantiasis.

10. (With F. S. McKinney.) Preparation of Anatomic Model Showing Action of Muscles of the Extremities.

OWEN H. WANGENSTEEN, B.A., M.D., Teaching Fellow in Surgery.

The Undescended Testis: An Experimental and Clinical Study. (Thesis to be offered for the degree of Ph.D. in Surgery; under the direction of R. E. Scammon and A. C. Strachauer.)

The testes of adult male dogs when placed in the peritoneal cavity show marked degeneration in the germinal epithelium after a few days. In young dogs, before spermatogenesis has occurred, these degenerative changes are not observed. Ligation of the vas deferens is not accompanied by changes in the testis. Ligation of the pampiniform plexus of veins and the internal spermatic artery produces atrophy. Ligation of the internal spermatic artery alone produces no change in the germinal epithelium. Manipulation and loosening of the testis and cord without removing the testis from the scrotum is followed by temporary histological changes similar to those observed after transplantation. Testes transplanted into the abdomen when returned to the scrotum approach the normal condition after a few months.

The cryptorchid human testis shows almost total absence of the germinal epithelium. In subjects just past puberty, spermatogonia are usually present in the testes. The normally descended testis from birth to puberty grows but slightly and shows very little histological change until spermatogenesis occurs. Undescended testes until puberty are very like the normal. With reposition in the scrotum before puberty changes supervene, the normal development of an imperfectly descended testis should occur.



## THE GRADUATE SCHOOL

### THE MAYO FOUNDATION FOR MEDICAL RESEARCH

#### BACTERIOLOGY AND IMMUNOLOGY

EDWARD C. ROSENOW, M.D., Professor of Experimental Bacteriology.

1. Streptococci in the Etiology of Epidemic Encephalitis, Spasmodic Torticollis, Respiratory Arrhythmia, and Chorea. *Journal-Lancet*, 44:479-81. 1924.

2. Experimental and Clinical Studies on Focal Infection and Elective Localization; Newer Findings and Their Significance. *Journal of the American Dental Association*, 11:963-82. 1924.

3. A Precipitin Reaction in Epidemic Poliomyelitis. *Proceedings of the Society for Experimental Biology and Medicine*, 22:155-56. 1924.

4. Further Studies on the Etiology of Epidemic Hiccough. *Ibid.*, 22:187-88. 1924.

5. A Precipitating and Neutralizing Antistreptococcus (Scarlatinal) Horse Serum. *Ibid.*, 22:189-93. 1924.

6. A Specific Precipitin Reaction in Epidemic Poliomyelitis. *Journal of the American Medical Association*, 84:429-32. 1925.

7. The Production of Urinary Calculi by the Devitalization and Infection of Teeth in Dogs with Streptococci from Cases of Nephrolithiasis. *Journal of the Iowa State Medical Society*, 15:297-301. 1925.

8. Further Studies on the Precipitin Reaction in Poliomyelitis. *Archives of Internal Medicine*. (In press.)

9. The Precipitin and Neutralizing Reactions in the Diagnosis of Scarlet Fever and Allied Hemolytic Streptococcus Infections. *Journal of the American Medical Association*. (In press.)

10. Localization of Streptococci from Cases Presenting Diverse Manifestations of Neuromyelo-Encephalitis That Occurred During and Following an Epidemic of Hiccough. *Journal of Infectious Diseases*. (In press.)

ARTHUR H. SANFORD, M.A., M.D., Professor of Clinical Bacteriology and Parasitology.

1. Modified Gram Stain (Ruhland). *Journal of Laboratory and Clinical Medicine*, 10:668. 1925.

2. (With Minna Voelker.) Actinomycosis in the United States. *Archives of Surgery*. (In press.)

3. The Anticomplementary Reaction of Blood Serum or of Spinal Fluid. *Journal of Laboratory and Clinical Medicine*. (In press.)

WINIFRED ASHBY, Ph.D., Assistant in Experimental Bacteriology.

1. The Present Status of the Question of the Length of Life of the Unagglutinable Transfused Red Blood Corpuscle. *Archives of Internal Medicine*, 34:481-89. 1924.

2. Blood Volume. I. A Method for Determining Whole Blood Volume Based on the Circulating Corpuscle Volume. *Ibid.*, 35:516-26. 1925.

3. Blood Volume. II. The Equality between Total Blood Volumes Estimated by a Method Involving Corpuscle Content Determination, and Those Estimated from Plasma Volume Determinations. *Ibid.*, 35:632-40. 1925.

4. Blood Volume. III. Changes in Blood Volume Indicated by Transfusion, and Their Bearing on Methods of Determining Blood Volume by Means of the Degree of Change in a Constituent of the Blood, Following Transfusion of a Known Amount of that Constituent. *Ibid.*, 35:641-49. 1925.

5. Blood Volume. IV. Diurnal Fluctuations in Blood Volume and Change Incident to Transfusion Reaction. *Ibid.* (In press.)

6. Blood Volume. V. The Effect of Treatment on the Blood Volume of Patients with Pernicious Anemia. *Ibid.* (In press.)

7. Blood Volume. VI. The Relationship between Blood Volume, Total Corpuscle Content, and Alkaline Reserve, in Cases of Pernicious Anemia. *Ibid.* (In press.)

ANTONIO CANTERO, B.A., M.D., C.M., Assistant in Experimental Bacteriology.

Bacteriology of the Thyroid Gland in Goiter. *Surgery, Gynecology, and Obstetrics.* (In press.)

A. C. NICKEL, B.S., M.D., Assistant in Experimental Bacteriology.

1. (With W. H. Von Lackum.) Carrying Out Bacteriologic Studies of Various Body Foci, with Particular Relation to the Determining of the Origin of Hematogenous Prostatitis.

2. (With W. H. Von Lackum.) Extensive Studies in Experimental Arthritis, Using Growths of Bacteria from Prostatic Secretions.

3. Tissue Bacteriology of Exophthalmic Goiter.

4. (With R. W. Matchett.) Studies in Elective Localization of Bacteria from Cultures of Pulpless Teeth.

LUTHER THOMPSON, M.A., Fellow in Bacteriology.

The Blood-Agar Plate for Spore-Forming Anaërobcs. *Journal of Bacteriology.* (In press.)

## MEDICINE

LEONARD G. ROWNTREE, M.D., D.Sc., Professor of Medicine and Chief of the Department of Medicine.

1. Studies in Diabetes Insipidus. *Journal of the American Medical Association*, 83:399-405. 1924.

2. Studies in Addison's Disease. *Ibid.*, 84:327-35. 1925.

3. The Rôle of Functional Tests in the Study of Diseases of the Liver. *Medical Clinics of North America*, 8:1389-401. 1925.

4. (With C. H. Greene and A. M. Snell.) Clinical and Experimental Studies in Diseases of the Liver. II. A Comparative Study of Certain Tests for Hepatic Function in Experimental Obstructive Jaundice. *Archives of Internal Medicine*. (In press.)

5. (With G. E. Brown.) The Volume and Composition of the Blood, and the Changes Incident to Diuresis, in Cases of Edema. *Ibid.*, 35:129-46. 1925.

6. (With G. E. Brown.) Right-sided Carotid Pulsations in Cases of Severe Hypertension. *Journal of the American Medical Association*, 84: 1016-19. 1925.

7. The Ductless Glands and Glandular Therapy. *Nelson's Loose-Leaf Medicine*. 1925.

8. An Evaluation of Therapy, with Special Reference to Organotherapy. *Endocrinology*. (In press.)

9. (With G. E. Brown.) A Tintometer for the Analysis of the Color of the Skin. *American Journal of the Medical Sciences*. (In press.)

10. (With C. H. Greene, C. S. McVicar, and W. Walters.) Clinical and Experimental Studies in Diseases of the Liver. IV. Functional Tests in Cases of Carcinoma of the Liver and Biliary Tract. *Archives of Internal Medicine*. (In press.)

11. (With C. H. Greene, C. S. McVicar, and W. Walters.) Clinical and Experimental Studies in Diseases of the Liver. III. A Comparative Study of Certain Tests for Hepatic Function in Patients with Obstructive Jaundice. *Ibid.* (In press.)

12. The Determination of the Functional Capacity of the Kidney. *Osler's System of Medicine*. (In press.)

13. (With C. W. Barrier.) Diuretic Effect of Novasurol in the Ascites of Portal Obstruction. *Collected Papers of the Mayo Clinic and Mayo Foundation*, 16:221-23. 1924.

HENRY S. PLUMMER, M.D., Professor of Medicine.

1. Medical Treatment of Hyperthyroid Cases. *Transactions of the Association of Resident and Ex-Resident Physicians of the Mayo Clinic*, 5:66-67. 1924.

2. (With W. M. Boothby.) The Administration of Thyroid Preparations. *Journal of the American Medical Association*, 83:1333-35. 1924.

3. (With C. H. Mayo.) The Results of Iodin Administration in Exophthalmic Goiter. *Transactions of the American Surgical Association*. 1925.

WALTER D. SHELDEN, B.S., M.D., Professor of Neurology.

The Nervous System: a Clinic. *Journal-Lancet*, 44:389-92. 1924.

JOHN H. STOKES, B.A., M.D., Professor of Dermatology.

1. (With L. W. Shaffer.) Results Secured by Standard Methods of

Treatment in Four Hundred and Five Cases of Neurosyphilis. *Journal of the American Medical Association*, 83:1826-34. 1924.

2. (With H. A. DesBrisay.) Observations on the Course of Four Hundred and Thirteen Cases of Untreated or Inadequately Treated Syphilis. *American Journal of Syphilis*, 8:558-68. 1924.

3. (With L. F. X. Wilhelm.) Tryparsamid in the Treatment of Neurosyphilis: a Study Based on Observation of 152 Patients for Eighteen Months. *Archives of Dermatology and Syphilology*, 11:579-610. 1925.

4. (With C. W. Behn.) Serological and Clinical Results in Various Types of Syphilis with Sulpharsphenamin Administered Intramuscularly. *Journal of the American Medical Association*, 83:242-46. 1924.

5. (With H. A. DesBrisay.) Certain Factors in the Diagnosis of Syphilis Unrecognized in the Earlier Years of the Infection. *Canadian Medical Association Journal*, 14:715-18. 1924.

6. Primary Inoculation Tuberculosis of the Skin with Metastasis to Regional Lymph-Nodes. *American Journal of the Medical Sciences*, 169:722-36. 1925.

RUSSELL M. WILDER, B.S., M.D., Ph.D., Professor of Medicine.

1. Care of Diabetic Patients Undergoing Operation. *Transactions of the Association of Resident and Ex-Resident Physicians of the Mayo Clinic*, 5:69-71. 1924.

2. "Optimal" Diets for Diabetic Patients. *Journal of the American Medical Association*, 83:733-37. 1924. *Dietary Administration and Therapy*, 2:540-48. 1924.

3. The Clinical Assaying of Insulin and the Insulin Requirement. *Endocrinology*, 8:630-38. 1924.

4. Indications for the Use of Insulin. *Northwest Medicine*, 23:444-47. 1924.

5. Glandular Therapy. Pancreatic Gland Preparations. III. Application in Internal Medicine. *Journal of the American Medical Association*, 83:1078-79. 1924.

6. (With Kathleen Sandiford.) Studies on the Metabolism of Fat: the Behaviour of an Uneven Fatty Acid (Intarvin) Fat. *Collected Papers of the Mayo Clinic and Mayo Foundation*, 16:1078-80. 1924.

7. Diabetes, Its Cause and Its Treatment with Insulin. (In press.)

The following problems have been under investigation:

8. Studies on High Feeding in Diabetes. Complete Metabolism Observations on the Subject "Leo S." (Ready for publication.)

9. Studies on Relationship of Hyperthyroidism and Diabetes.

10. Experimental Diabetes: Studies on Depancreatized Dogs.



WALTER M. BOOTHBY, M.A., M.D., Associate Professor of Medicine.

1. The Use of Iodin in Exophthalmic Goiter. *Endocrinology*, 8:727-45. 1924.

2. Iodin in the Prevention and Treatment of Goiter. *Journal of the Indiana State Medical Association*, 18:5-8. 1925.

3. (With F. A. Willius.) The Basal Metabolic Rate in Cases of Primary Cardiac Disease. *Medical Clinics of North America*, 8:1171-80. 1925.

4. (With R. Weiss.) The Effect of Insulin on the Respiratory Metabolism. *Proceedings of American Society of Biological Chemists*, 1924. *Journal of Biological Chemistry*, 63:1-11. 1925.

5. (With H. S. Plummer.) The Administration of Thyroid Preparations. *Journal of the American Medical Association*, 83:1333-35. 1924.

6. (With Irene Sandiford, Kathleen Sandiford, and Jean Slosse.) The Effect of Thyroxin on the Respiratory and Nitrogenous Metabolism of Normal and Myxedematous Subjects. I. A Method of Studying the Reserve or Deposit Protein with a Preliminary Report of the Results Obtained. *Transactions of the Association of American Physicians*. (In press.)

#### 7. Metabolism Experiments.

The data on the two long metabolism experiments, one on a myxedema for eleven months and one on a diabetic for seven months, are now being prepared for publication. Both these experiments were approximately complete metabolism studies; throughout the period of observation data were obtained on the protein, fat, and carbohydrate intake and on the various partition products of the urine and blood as well as on the respiratory metabolism at rest and at work. In the diabetic the chief problem was the study of the keto-antiketogenic ratio or the effect of high fat diets on the acetone excretion; the influence of such diets on the protein and respiratory metabolism were secondary problems. In the myxedema, however, the influence of thyroxin on the nitrogen partition products of the urine was of equal interest to its calorogenic action.

GEORGE B. EUSTERMAN, M.D., Associate Professor of Medicine.

1. Practical Aspects of Certain Phases of Treatment with Special Reference to Organotherapy and Physiotherapy. *Ohio State Medical Journal*, 20:677-80. 1924.

2. Certain Clinical and Pathological Aspects of Focal Infection with Special Reference to the Teeth and Tonsils and the Gastro-intestinal Tract. *Annals of Clinical Medicine*, 5:394-401. 1924.

3. Spontaneous Healing of Chronic Duodenal and Gastrojejunal Ulcer. *Medical Clinics of North America*, 8:1045-53. 1925.

4. Duodenal Ulcer Simulating the Gastric Crises of Tabes: Report of Five Cases. *Southern Medical Journal*, 18:319-23. 1925.

5. (With D. M. Berkman and T. S. Swan.) Primary Carcinoma of the Duodenum: Report of Fifteen Verified Cases. *Annals of Surgery*. (In press.)

6. (With A. B. Rivers.) Recurring Peptic Ulcer. *Annals of Clinical Medicine*. (In press.)

HERBERT Z. GIFFIN, B.S., M.D., Associate Professor of Medicine.

1. Splenectomy in Cases of Purpura Hemorrhagica. *Minnesota Medicine*, 8:207-14. 1925.

2. Four Cases of Hemorrhagic Purpura with Splenectomy. *Medical Clinics of North America*, 8:1153-61. 1925.

3. (With C. F. Dixon and J. G. Burns.) Observations on Pernicious Anemia Following Ileostomy. *Transactions of the Association of American Physicians*. (In press.) *Journal of the American Medical Association*. (In press.)

4. (With J. K. Holloway.) A Review of Twenty-eight Cases of Purpura Hemorrhagica with Splenectomy. *American Journal of Medical Sciences*. (In press.)

5. Pernicious Anemia and Polycythemia. (Work in progress.)

NORMAN M. KEITH, B.A., M.D., Associate Professor of Medicine.

1. (With H. P. Wagener.) Cases of Marked Hypertension, Adequate Renal Function, and Neuroretinitis. *Archives of Internal Medicine*, 34:374-87. 1924. *Transactions of the Association of American Physicians*, 39:39-44. 1924.

2. (With C. W. Barrier and Mary Whelan.) Treatment of Nephritis and Edema with Calcium. *Journal of the American Medical Association*, 83:666-70. 1924. *Dietary Administration and Therapy*, 2:554-62. 1924.

3. Certain Distinct Types of Renal Disease. *Medical Clinics of North America*, 8:1093-101. 1925.

4. (With Mary Whelan.) The Effect of Novasurol on the Composition of Blood and Urine. *American Journal of Physiology*, 72. 1925.

5. (With C. W. Barrier and Mary Whelan.) The Diuretic Action of Ammonium Chlorid and Novasurol in Cases of Nephritis with Edema. *Journal of the American Medical Association*. (In press.)

WILLIS S. LEMON, M.B., Associate Professor of Medicine.

1. (With A. E. Mahle.) Gangrenous Type of Postoperative Pneumonia. *Southwest Medicine*. (In press.)

2. Ectopic Adenomyoma: Postoperative Invasions of the Abdominal Wall. *Archives of Surgery*, 10:150-62. 1925.

3. (With A. E. Mahle.) The Differential Diagnosis in Cases of Ectopic Adenomyoma in the Groin. *Medical Clinics of North America*, 8:1125-35. 1925.

4. Lipoma of the Mediastinum. *Ibid.*, 8:1247-56. 1925.

5. A Clinical Survey of Thirty Cases of Proved Tuberculosis of the Pleura. *Surgery, Gynecology, and Obstetrics*. (In press.)

6. Experimental Study of Aspiration. *Archives of Surgery*. (In press.)

7. Intestinal Tuberculosis. III. Clinical Studies Relating to Diagnosis. *Transactions of the National Tuberculosis Association*. (In press.)

ARCHIBALD H. LOGAN, M.D., Associate Professor of Medicine.

1. (With J. A. Bargen.) Experimental Studies on the Etiology of Chronic Ulcerative Colitis: Suggestions for a More Rational Form of Treatment. *Journal of the American Medical Association*. (In press.)

HENRY W. WOLTMAN, B.S., M.D., Ph.D. in Neurology, Associate Professor of Neurology.

1. Headaches. *Medical Clinics of North America*, 8:1319-40. 1925.

The following problem is under investigation:

2. Degenerative Changes That May Occur in the Vegetative Nervous System in Pernicious Anemia.

DAVID M. BERKMAN, M.D., M.S. in Medicine, Assistant Professor of Medicine.

1. Practical Considerations in the Diagnosis of Chronic Abdominal Disease. *Minnesota Medicine*. (In press.)

2. (With G. B. Eusterman and T. S. Swan.) Primary Carcinoma of the Duodenum: Report of Fifteen Verified Cases. *Annals of Surgery*. (In press.)

GEORGE E. BROWN, M.D., Assistant Professor of Medicine.

1. Three Cases of Vascular Diseases Affecting the Feet (Thrombo-Angitis Obliterans, Raynaud's Disease, and Erythromelalgia). *Medical Clinics of North America*, 8:1189-202. 1925.

2. The Skin Capillaries in Raynaud's Disease. *Archives of Internal Medicine*, 35:56-73. 1925.

3. (With G. M. Roth.) Volume and Composition of the Blood in Addison's Disease. *American Journal of Medical Sciences*, 169:47-59. 1925.

4. (With L. G. Rowntree.) The Volume and Composition of the Blood, and the Changes Incident to Diuresis, in Cases of Edema. *Archives of Internal Medicine*, 35:129-46. 1925.

5. (With L. G. Rowntree.) Right-sided Carotid Pulsations in Cases of Severe Hypertension. *Journal of the American Medical Association*, 84:1016-19. 1925.

6. (With P. A. O'Leary.) Skin Capillaries in Scleroderma. *Archives of Internal Medicine*. (In press.)

7. (With F. A. Willius.) Coronary Sclerosis: an Analysis of Eighty-six Necropsies. *American Journal of Medical Sciences*, 168:155-80.

8. (With A. W. Adson.) Calorimetric Studies of the Extremities Following Lumbar Sympathectomy. *Ibid.* (In press.)

9. (With A. W. Adson.) Treatment of Raynaud's Disease by Lumbar Sympathetic Neurectomy. *Ibid.* (In press.)

10. (With L. G. Rowntree.) A Tintometer for the Analysis of the Color of the Skin. *Ibid.* (In press.)

11. (With L. G. Rowntree.) Vasodilatation Following Sympathetic Neurectomy. *Journal of Diseases of the Heart and Circulatory System*. (In press.)

12. (With Charles Sheard.) A Method for Instantaneous Photomicrography of the Skin Capillaries. *Journal of Laboratory and Clinical Medicine*. (In press.)

The following problems are under investigation:

13. Capillaries in Hypertension.

14. (With C. Sheard and R. Keggereis.) Calorimetric Studies in Obstructive Arterial Disease.

15. Calorimetric Determinations in Normals.

16. (With A. W. Adson.) Muscle Tonus in Spastic Paraplegia and Effects of Sympathectomy.

17. (With H. Z. Giffin.) Study in Polycythemia. Treatment with Phenylhydrazine. Blood Volume Studies.

18. (With G. Roth.) Inorganic and Organic Salts.

19. (With G. Roth.) The Normal Capillary.

20. (With F. S. Adams.) Blood in Hypertension. Relationship of Anemia.

21. Skin Temperatures. Studies of Vasomotor Activity in Pathological Conditions and Normal Capillary Reaction at Different Ages.

22. (With L. G. Rowntree.) Blood Volumes in Heat and Cold. Different Environmental Temperatures.

23. Therapeutic Action of Drugs and Baths. Rest in Treatment of Hypertension.

FRED W. GAARDE, B.S., M.D., Assistant Professor of Medicine.

1. Clinical Differentiation of Cases with Abnormal X-Ray Shadows in the Mediastinum. *Medical Clinics of North America*, 8:1235-46.

2. Diseases of the Mediastinum. In *Bedside Diagnosis*. Philadelphia: W. B. Saunders Co.

WILLIAM H. GOECKERMAN, M.D., Assistant Professor of Dermatology.

1. The Treatment of Lupus Erythematosus by Filtered X-Ray to the Gland-Bearing Regions of the Body. *Medical Journal and Record*, 120:530-33. 1924.

2. The Effect of Surgical Trauma in Patients with Syphilis, with Special Reference to Healing of the Postoperative Wound. *Surgery, Gynecology, and Obstetrics*, 40:77-83. 1925.

3. The Cure of Syphilis. *Medical Clinics of North America*, 8:1215-20. 1925.

4. A Peculiar Discoloration of the Skin. Supplementary Note. *Journal of the American Medical Association*, 84:506-7. 1925.

5. The Treatment of Psoriasis. *Northwest Medicine*, 24:229-31. 1925.



6. (With P. A. O'Leary and S. T. Parker.) A Preliminary Report on the Treatment of Neurosyphilis by Malaria. *Archives of Dermatology and Syphilology*. (In press.)

7. Recent Advances in the Treatment of Syphilis. *Minnesota Medicine*. (In press.)

8. The Itching Skin: a Symptom of Systemic Disease. *Medical Journal and Record*. (In press.)

PAUL A. O'LEARY, M.D., Assistant Professor of Dermatology.

1. Stigmas of Late Congenital Syphilis. *Minnesota Medicine*, 7:651-56. 1924.

2. The Cutaneous Lesions of Late Syphilis. *Ibid.*, 7:766-73. 1924.

3. (With H. M. Conner.) Purpura Hemorrhagica As a Complication in the Treatment of Syphilis with Sulpharsphenamin. *American Journal of Syphilis*, 9:262-73. 1925.

4. Postarsphenamin Jaundice. *Medical Clinics of North America*, 8:1203-13. 1925.

5. (With G. B. New.) Pemphigus from the Laryngologist's Standpoint. *Archives of Oto-Laryngology*. (In press.)

6. (With G. E. Brown.) Skin Capillaries in Scleroderma. *Archives of Internal Medicine*. (In press.)

7. (With W. H. Goeckerman and S. T. Parker.) A Preliminary Report on the Treatment of Neurosyphilis by Malaria. *Archives of Dermatology and Syphilology*. (In press.)

8 (With M. O. Nelson.) Significance of Normal Spinal Fluid in Cases of Neurosyphilis. *Journal of the American Medical Association*. (In press.)

9. The Significance of the Negative Spinal Fluid Examination in Neurosyphilis.

Results: It was found that neurosyphilis may be present in an active or progressive state even after the spinal fluid test has been negative for a period of a year or more. A list is given of the symptoms occurring after the spinal fluid has been negative for a year or more, and the frequency of their occurrence tabulated. In 70 per cent of the first group and 45 per cent of the second, continued treatment had a favorable effect on the symptoms that had persisted after the spinal fluid had been negative for one year. The single negative spinal fluid test is of no more significance in indicating the arrest of neurosyphilis than is the serum Wassermann reaction in relation to visceral syphilis. Repeated spinal fluid tests at intervals of about one year are indicated until the patient becomes asymptomatic. Work in progress.

WILLIAM A. PLUMMER, M.D., Assistant Professor of Medicine.

Iodin in the Treatment of Goiter. *Medical Clinics of North America*, 8:1145-51. 1925.

LEE W. POLLOCK, B.S., M.D., Assistant Professor of Medicine.

(With E. S. Judd.) Diverticulitis of the Colon. *Annals of Surgery*, 80:425-38. 1924.

AVERY D. PRANGEN, B.S., M.D., Assistant Professor of Ophthalmology.

Early Care of Cross-eyed Children. *Medical Clinics of North America*, 8:1221-25. 1925.

FREDERICK A. WILLIUS, M.D., M.S. in Medicine, Assistant Professor of Medicine.

1. Administration of Digitalis by Rectum. *Northwest Medicine*, 23:114-15. 1924.

2. (With A. R. Barnes.) Chronic Adherent Pericarditis. *Journal of the Indiana State Medical Association*, 17:101-3. 1924.

3. Subacute Bacterial Endocarditis. *Southwestern Medicine*, 8:203-5. 1924.

4. Diseases of the Myocardium. *Journal of the Iowa State Medical Society*, 14:370-74. 1924.

5. A Clinical Study of Complete Heart Block. *Annals of Clinical Medicine*, 3:129-35. 1924.

6. (With G. E. Brown.) Coronary Sclerosis: An Analysis of Eighty-six Necropsies. *American Journal of the Medical Sciences*, 168:165-80. 1924.

7. Clinical Features of Coronary Sclerosis. *Minnesota Medicine*, 7:575-77. 1924.

8. (With A. R. Barnes.) Paroxysmal Tachycardia with Special Reference to Prognosis. *Boston Medical and Surgical Journal*, 191:666-70. 1924.

9. Thyroid Preparations in the Treatment of the Stokes-Adams' Syndrome. *Canadian Medical Association Journal*, 14:1072-76. 1924.

10. (With J. Fitzpatrick.) Life Expectancy with Aortic Regurgitation. *Medical Journal and Record*, 120:417-21. 1924.

11. Acute Coronary Obstruction. *Medical Clinics of North America*, 8:1181-87. 1925.

12. Paroxysmal Tachycardia with Multiple Foci of Stimulus Production. *Annals of Clinical Medicine*, 3:537-43. 1925.

13. Myocardial Infarction: An Electrocardiographic Study. A Report of Nine Cases from the Mayo Clinic, and a Review of Twenty-four Published Cases. *Journal of Laboratory and Clinical Medicine*, 10:427-45. 1925.

14. The Heart in Prostatic Hypertrophy. *Journal of Urology*, 13:337-42. 1925.

15. Infarction of the Myocardium: Report of Two Cases with Detailed Electrocardiographic Observations. (In press.)

16. (With S. F. Haines.) Intermittent Ventricular Fibrillation with Complete Recovery: Report of a Case. *Boston Medical and Surgical Journal*. (In press.)

17. (With S. F. Haines.) The Status of the Heart in Myxedema. (In press.)

18. Prognosis in Heart Disease. *Illinois Medical Journal*. (In press.)

19. (With W. M. Boothby.) The Basal Metabolic Rate in Cases of Primary Cardiac Disease. *Medical Clinics of North America*, 8:1171-80. 1925.

20. (With Julia M. Fitzpatrick.) The Relationship of Chronic Infection of the Gall-Bladder to Disease of the Cardiovascular System. (In press.)

The following problems are under investigation:

21. (With A. R. Barnes.) Myocardial Degeneration: a Clinical, Pathologic, and Electrocardiographic Correlation.

22. (With A. R. Barnes.) Paroxysmal Tachycardia with Cerebral Manifestations.

23. The Mode of Death in Various Types of Heart Disease.

24. (With A. R. Barnes.) The Use of Theobromin and Allied Substances in Angina Pectoris.

25. (With A. R. Barnes.) Toxic Cerebral Effects of Digitalis in Heart Disease.

26. (With P. A. O'Leary.) The Results of Treatment in Syphilitic Cardiovascular Disease. Syphilitic Aortitis. Syphilitic Aortic Insufficiency. Aortic Aneurysm.

ARLIE R. BARNES, M.A., M.D., Instructor in Medicine.

1. (With F. A. Willius.) Chronic Adherent Pericarditis. *Journal of the Indiana State Medical Association*, 17:101-3. 1924.

2. (With F. A. Willius.) Paroxysmal Tachycardia with Special Reference to Prognosis. *Boston Medical and Surgical Journal*, 191:666-70. 1924.

3. (With F. A. Willius.) Myocardial Infarction: an Electrocardiographic Study. *Journal of Laboratory and Clinical Medicine*, 10:427-45.

LOUIS A. BUIE, B.A., M.D., Instructor in Medicine.

1. The Value of Proctology in General Practice. *Minnesota Medicine*, 7:604-5. 1924.

2. Treatment of Anal Pruritus by Ionization. *Transactions of the American Proctologic Society*, 1924.

3. (With C. F. McCuskey.) Sacral Anesthesia in Rectal Surgery. *Ibid.*, 1925.

4. The Diagnosis and Treatment of the More Common Diseases of the Anus, Rectum, and Sigmoid. *Surgical Clinics of North America*. (In press.)

HARRY M. CONNER, M.D., Instructor in Medicine.

1. Symptoms and Diagnosis of Nontuberculous Pulmonary Suppuration. *Medical Clinics of North America*, 8:1257-72. 1925.

2. (With P. A. O'Leary.) Purpura Hemorrhagica As a Complication in the Treatment of Syphilis with Sulpharsphenamin. *American Journal of Syphilis*, 9:262-73. 1925.

The following problems are under investigation:

3. (With S. Offutt.) Blood Coagulation Factors during the Menstrual Cycle.

4. (With H. C. Bumpus.) Investigation of the Blood in Essential Hematuria.

5. Investigation of Blood in Menorrhagia Not Explained by Local Conditions.

6. (With C. H. Greene.) Liver Function in Various Blood and Spleen Conditions.

7. (With L. Madsen.) The Relation of Heredity to Pernicious Anemia.

JOHN B. DOYLE, B.S., M.D., M.S. in Neurology, Instructor in Neurology.

1. Clinical Manifestations and Treatment of Epidemic Encephalitis. *California and Western Medicine*, 22:558-62. 1924.

2. Glossopharyngeal Neuralgia. *Transactions of the Association of Resident and Ex-Resident Physicians of the Mayo Clinic*, 5:41-42. 1924.

3. The Recognition of Psychoneuroses. *California and Western Medicine*. (In press.)

CARL H. GREENE, M.D., Ph.D., Instructor in Medicine.

1. Functional Tests in Hepatic Disease. *Minnesota Medicine*, 8:142-45. 1925.

2. (With L. G. Rowntree and A. M. Snell.) Clinical and Experimental Studies in Diseases of the Liver. II. A Comparative Study of Certain Tests for Hepatic Function in Experimental Obstructive Jaundice. *Archives of Internal Medicine*. (In press.)

3. The Clinical Use of Tests for Hepatic Function. *Journal of the American Medical Association*. (In press.)

4. (With C. S. McVicar, W. Walters, and L. G. Rowntree.) Clinical and Experimental Studies in Diseases of the Liver. III. A Comparative Study of Certain Tests for Hepatic Function in Patients with Obstructive Jaundice. *Archives of Internal Medicine*. (In press.)

5. (With C. S. McVicar, W. Walters, and L. G. Rowntree.) IV. Functional Tests in Cases of Carcinoma of the Liver and Biliary Tract. *Ibid.* (In press.)

SAMUEL F. HAINES, B.S., M.D., Instructor in Medicine.

1. (With F. A. Willius.) Intermittent Ventricular Fibrillation with Complete Recovery: Report of a Case. *Boston Medical and Surgical Journal*. (In press.)

2. The Status of the Heart in Myxedema. Read before the American Heart Association, Atlantic City, May 26, 1925.



HOWARD R. HARTMAN, B.S., M.D., Instructor in Medicine.

1. The Prognostic Value of Gastric Acidity in Cases of Resectable Carcinoma. *Journal of the American Medical Association*, 83:1976-77. 1924.
2. Peptic Ulcer and Palpable Masses. *Medical Clinics of North America*, 8:1041-43. 1925.
3. (With P. P. Vinson.) Pyloric Obstruction Due to Swallowing a Solution of Concentrated Lye. *Medical Clinics of North America*, 8:1037-40. 1925.

CHARLES S. McVICAR, M.D., Instructor in Medicine.

1. A Discussion of the Clinical and Laboratory Findings in Certain Cases of Obstruction in the Upper Gastro-intestinal Tract. The Rôle of Blood Chemistry in Diagnosis, Prognosis and Treatment of This Condition. *American Journal of the Medical Sciences*, 169:224-35. 1925.
2. Problems in the Diagnosis and Treatment of Gastro-intestinal Disorders. *Medical Clinics of North America*, 8:1055-64. 1925.
3. The Medical Treatment of Toxemia Associated with Gastric Stasis, Obstructive and Non-obstructive. *Minnesota Medicine*, 1925. (In press.)
4. (With L. G. Rowntree, C. H. Greene, and W. Walters.) Clinical and Experimental Studies in Diseases of the Liver. III. A Comparative Study of Certain Tests for Hepatic Function in Patients with Obstructive Jaundice. *Archives of Internal Medicine*. (In press.)
5. (With L. G. Rowntree, C. H. Greene, and W. Walters.) Clinical and Experimental Studies in Diseases of the Liver. IV. Functional Tests in Cases of Carcinoma of the Liver and Biliary Tract. *Ibid.* (In press.)

HARRY L. PARKER, B.A., M.B., Ch.B., M.S. in Neurology, Instructor in Neurology.

1. Unusual Forms of Pain in the Area of the Fifth Nerve. *Journal of the American Medical Association*, 83:1672-78. 1924.
2. Clinical Types of Vertigo. *Medical Clinics of North America*, 8:1307-17. 1925.
3. (With A. W. Adson.) Compression of the Spinal Cord and Its Roots by Hypertrophic Osteo-Arthritis. Diagnosis and Treatment. *Surgery, Gynecology, and Obstetrics*. (In press.)

PORTER P. VINSON, B.A., M.D., Instructor in Medicine.

1. Foreign Bodies in the Esophagus and Air Passages. *Minnesota Medicine*, 7:546-48. 1924.
2. The Value of the X-Ray in the Diagnosis and Treatment of Diseases of the Esophagus. *Radiology*, 3:105-9. 1924.
3. (With G. B. New.) Metastasis from Symptomless Cancer of the Esophagus. *Medical Journal and Record*, 120:19-20. 1924.
4. Unusual Position of an Open Safety Pin in the Esophagus. *Radiology*, 4:129-30. 1925.

5. Cancer of the Esophagus. *Medical Clinics of North America*, 8:1027-36. 1925.

6. (With H. R. Hartman.) Pyloric Obstruction Due to Swallowing a Solution of Concentrated Lye. *Ibid.*, 8:1037-40. 1925.

7. Dilation versus Gastrostomy As a Palliative Treatment of Carcinoma of the Esophagus. *Journal of the American Medical Association*, 84:658-59. 1925.

8. Severe Burn of Mouth from the Accidental Ingestion of Granulated Lye. *Laryngoscope*, 35:127-28. 1925.

9. Esophageal Obstructions in Childhood. *Archives of Pediatrics*, 62:111-12. 1925.

10. The Diagnosis and Preoperative Management of Pharyngo-esophageal Diverticula. *Journal of the American Medical Association*. (In press.)

11. Epigastric Pain a Symptom of Esophageal Obstruction. *Annals of Surgery*. (In press.)

12. (With A. C. Broders.) A Case of Squamous-Cell Epithelioma of the Stomach. *Journal of Laboratory and Clinical Medicine*. (In press.)

13. Cardiospasm. (In press.)

14. (With H. H. Bowing.) Surgical Diathermy for Tumors of the Trachea. (In press.)

SAMUEL F. ADAMS, M.D., Fellow in Medicine.

1. (With R. M. Wilder.) The Surgical Risk of the Diabetic Patient. *Surgical Clinics of North America*, 4:587-93. 1924.

2. Insulin Therapy in Diabetes Mellitus. *Medical Woman's Journal*, 31:160-63. 1924.

3. Three Cases of Pernicious Anemia and Diabetes Mellitus with a Note on the Apparent Ineffectiveness of Insulin in the Presence of a Profound Anemia. *Medical Clinics of North America*, 8:1163-70. 1925.

4. Is Disease of the Gallbladder a Cause of Diabetes Mellitus? *Surgery, Gynecology, and Obstetrics*. (In press.)

5. (With B. E. Hempstead.) Diabetes in the Practice of Oto-Laryngology. *Archives of Oto-Laryngology*, 1:181-85. 1925.

In addition, work is in progress upon the following:

6. Continuation of the Study of the Relationship between Diseases of the Gallbladder and Diabetes.

7. (With E. O. G. Schmitt.) A Study of a Group of Patients with Diabetes and Arthritis.

8. (With G. E. Brown.) A Study of the Blood in Hypertension.

Attempting to show that patients with hypertension and arteriosclerosis with renal insufficiency have an anemia that is similar to the anemia seen in patients with chronic glomerular nephritis.

EDWARD W. ANDERSON, M.D., Fellow in Medicine.

The following problems have been studied:

1. Blood Studies in Nephrosis, with Relation to the Incidence of Anemia.

2. Effects of Intravenous Use of Radium Chloride on Blood Pressure.

JACOB A. BARGEN, B.S., M.D., Assistant in Medicine.

1. Experimental Studies on the Etiology of Chronic Ulcerative Colitis: preliminary report. *Journal of the American Medical Association*, 83:332-36. 1924.

2. (With A. H. Logan.) Experimental Studies on the Etiology of Chronic Ulcerative Colitis: Suggestions for a More Rational Form of Treatment. *Ibid.* (In press.)

CHARLES W. BARRIER, JR., B.S., M.D., Fellow in Medicine.

1. A Study of the Histogenesis and Pathology of Goiter, with Special Reference to Adenomatous Goiter with Hyperthyroidism. *Transactions of the Association of Resident and Ex-Resident Physicians of the Mayo Clinic*, 5:43-44. 1924.

2. (With N. M. Keith and Mary Whelan.) Treatment of Nephritis and Edema with Calcium. *Journal of the American Medical Association*, 83:666-70; *Dietary Administration and Therapy*, 2:554-62. 1924.

3. (With L. G. Rowntree.) Diuretic Effect of Novasurol in the Ascites of Portal Obstructions. *Collected Papers of the Mayo Clinic and Mayo Foundation*. Philadelphia: Saunders, 16:221-23. 1924.

4. (With N. M. Keith and Mary Whelan.) The Diuretic Action of Ammonium Chlorid and Novasurol in Cases of Nephritis with Edema. *Journal of the American Medical Association*. (In press.)

SAMUEL W. BECKER, B.S., M.D., Fellow in Dermatology.

1. Osteosis Cutis. *Archives of Dermatology and Syphilology*, 10:163-72. 1924.

2. Dermatitis in Association with Disease or Injury of the Peripheral Nerves. *Ibid.* (In press.)

MANDRED W. COMFORT, B.A., M.D., Fellow in Neurology.

1. Chronic Anterior Poliomyelitis with Achondroplasia. Report of a Case. *Medical Clinics of North America*, 8:1287-93. 1925.

2. The Circulation of the Brain.

A study to determine the distribution of the several arteries, their anastomoses, and the relationship of the functional divisions of the brain to blood supply. Injection and corrosion methods are being utilized. The several arteries are injected simultaneously with a solution of gelatin containing soluble dyes, and barium or sodium iodid. After roentgenographic study, the brains are sectioned horizontally or vertically and the structures supplied by each artery ascertained by their coloring. Sufficient progress has not been made to warrant conclusions.

H. A. DES BRISAY, M.D., C.M., Fellow in Medicine.

1. (With J. H. Stokes.) Observations on the Course of Four Hundred and Thirteen Cases of Untreated or Inadequately Treated Syphilis. *American Journal of Syphilis*, 8:558-68. 1924.

2. (With J. H. Stokes.) Certain Factors in the Diagnosis of Syphilis Unrecognized in the Earlier Years of the Infection. *Canadian Medical Journal*, 14:715-18. 1924.

ROBERT K. DIXON, B.S., M.D., Fellow in Medicine.

The following problem has been under investigation:

(With H. E. Robertson.) A Study of Post-operative Pulmonary Complications.

HERBERT V. DOBSON, B.A., M.D., Fellow in Medicine.

1. Effect of Histamin on Gastric Secretion with Especial Reference to Achlorhydria: preliminary report. *Journal of the American Medical Association*, 84: 158-61. 1925.

The following problem has been under investigation:

2. Studies in Gastric Secretion: Acid and Enzyme Therapy in Achlorhydria.

HAROLD L. DUNN, Ph.D., M.D., Fellow in Medicine.

The Visiograph: A New Engineering Instrument. Military Engineer. (In press.)

FRANCES A. FORD, B.S., M.D., Fellow in Medicine.

The following have been under investigation:

1. Survey of Cases of Fibromyomata of the Uterus.

Comparative study of 250 cases treated surgically and 350 cases treated by radiation to determine end results of the two methods of treatment.

2. Study of the X-Ray Dosage Given to Guinea Pigs Which Does Not Seriously Affect Their General Health.

3. Review of Cases of Tuberculous Adenitis and Peritonitis Which Have Been Treated by X-Rays at the Clinic.

JOHN D. GARVIN, B.A., M.D., Fellow in Medicine.

1. The Fouchet Test in Cholecystitis. *Journal of the American Medical Association*, 84:492-93. 1925.

2. Obesity and Hypertension. *Journal of Clinical Investigation*. (In press.)

3. (With H. W. Meyerding and R. D. Carman.) Metastasis to the Bones from Carcinoma of the Breast: a Roentgenologic Study. *Radiology*. (In press.)

JOHN F. GIPNER, B.A., M.D., Fellow in Ophthalmology.

1. The Ophthalmologic Findings in Cases of Multiple Sclerosis: a Study of 100 Cases. *Medical Clinics of North America*, 8:1227-34. 1925.



2. (With H. P. Wagener.) Coloboma of the Iris, Choroid, and Optic Disc, with Detachment of the Retina. *American Journal of Ophthalmology*. (In press.)

3. Mucocele of the Frontal Sinus Simulating Orbital Neoplasm. *Surgical Clinics of North America*. (In press.)

4. (Under the direction of W. L. Benedict and H. P. Wagener.) A Histopathologic Study of the Retinitis Found in Two Cases of Cardiovascular Renal Disease.

*Purpose*.—To present complete clinical and pathological findings of the cases which are classified according to Volhard and Fahr's classifications of nephritis; to compare the ophthalmoscopic and microscopic appearance of the retinitis; and to compare the vascular sclerosis in the eye with that found in the rest of the body. Work incomplete.

HIROTOSHI HASHIMOTO, M.D., Fellow in Medicine.

1. Transient Change in the Auriculoventricular Conduction Following the Injection of Histamine Dichlorid. *Archives of Internal Medicine*, 35:609-25. 1925.

2. Blood Chemistry in Acute Histamine Intoxication. *Journal of Pharmacology and Experimental Therapeutics*. (In press.)

PHILIP S. HENCH, B.A., M.D., Fellow in Medicine.

1. A Note on Renal Functional Tests for the General Practitioner (with Special Reference to the Salivary Urea Index). *Northwest Medicine*, 23:539-42. 1924.

2. The Protean Manifestations of Chronic Infectious Arthritis (with a Note on Treatment). *Medical Clinics of North America*, 8:1295-306. 1925.

3. The Systemic Nature of Chronic Infectious Arthritis. *Atlantic Medical Journal*, 28:425-36. 1925.

4. (With Martha Aldrich.) The Mercury Combining Power of Deproteinized Blood. *Proceedings of the Society of Experimental Biology and Medicine*. (In press.)

5. (With A. M. Snell and C. H. Greene.) Clinical and Experimental Observations on the Intravenous Use of Mercurochrome. *Collected Papers of the Mayo Clinic and the Mayo Foundation*. Philadelphia: Saunders, 16:1081-83.

6. (With A. M. Snell and C. H. Greene.) The Excretion of Mercurochrome in the Bile. *Ibid.*, 16:160-61.

7. (With Martha Aldrich.) The Mercury Combining Power of Protein-free Blood.

Problem still under investigation.

LESTER D. HUFFMAN, B.S., M.D., Fellow in Medicine.

Metabolism in the Hydrazine Therapy of Polycythemia Vera.

Problem still under investigation.

ALVIN R. HUFFORD, M.S., M.D., Fellow in Medicine.

(With L. G. Rowntree.) The Use of Lactose: Basic Diet in the Study and Treatment of Hypertension.

Problem still under investigation.

CASIMIOR B. LARA, M.D., Fellow in Medicine.

The following problems have been under investigation with L. G. Rowntree:

1. Functional and Pathological Studies with Chaulmoogra Derivatives.
2. Metabolism Studies with Chaulmoogra Derivatives.

JOHN E. MCCORVIE, M.B., Fellow in Medicine.

Studies on the Morning Alkaline Tide of Urine in Normal Persons and in Patients with Nephritis. *Journal of Clinical Investigation*. (In press.)

FREDERICK P. MOERSCH, B.S., M.D., Fellow in Neurology.

Psychic Manifestations in Cases of Brain Tumors. *American Journal of Psychiatry*, 4:705-24. 1925.

EARL D. OSBORNE, M.D., Fellow in Dermatology.

The Clinical and Serologic Value of the Colloidal Benzoin Reaction. *Archives of Dermatology and Syphilology*. (In press.)

ANDREW B. RIVERS, M.D., Fellow in Medicine.

1. (With W. H. Bueermann.) Recurring Epileptiform Attacks with Symptoms of Spasm at the Cardia: Report of Three Cases. *Medical Clinics of North America*, 8:1341-49. 1925.

2. (With G. B. Eusterman.) Recurring Peptic Ulcer. *Annals of Clinical Medicine*. (In press.)

The following problems have been under investigation:

3. Incidence, Diagnosis, and Symptomatology of Recurring Peptic Ulcer.

4. A Study of Perforating and Hemorrhagic Ulcers.

5. Further Studies on the Incidence of Secondary Peptic Ulcer.

6. (With J. S. Reid.) Investigations Regarding the Incidence of Hyperacidity Immediately before and after Surgery and the Relationship of This Condition to Possible Recurrences.

PAUL R. ROCKWOOD, B.A., M.D., Fellow in Medicine.

1. Physicochemical Aspects of Hemolysis. II. An Ultramicroscopic Study of Hemolysis. *Journal of Laboratory and Clinical Medicine*, 10:19-31. 1924.

2. Bread Substitutes in Diabetic Diets. *Minnesota Medicine*, 8:113-15. 1925.

3. Lessons of Nutrition Derived from the Great War. (The Wellcome Silver Medal Prize Essay, 1924.) *Military Surgeon*, 56:385-413. 1925.

4. (With E. C. Mason.) Some Physicochemical Aspects of Hemolysis. *Journal of Laboratory and Clinical Medicine*, 10:10-18. 1924.

5. (With E. C. Mason.) Physicochemical Aspects of Hemolysis. III. A Further Study of the Factors Involved. *Ibid.* (In press.)

6. Physicochemical Aspects of Hemolysis. IV. The Relation of the Acidity of Phosphate Buffers to Biologic Hemolysis. *Journal of Immunology*. (In press.)

7. Syndrome of Blue Sclerotics and Brittle Bones. *Wisconsin Medical Journal*. (In press.)

The following problems have been under investigation:

8. (With W. M. Boothby.) A Study of High Respiratory Quotients in Man.

9. (With N. M. Keith.) Medical Sequelae of the Nephropathies of Pregnancy.

10. (In Dr. Sheard's laboratory.) Ultraviolet Photography of the Erythrocyte.

CHRISTIAN J. ROHWER, B.S., M.D., Fellow in Neurology.

Benign Extravertebral Tumors: Report of Three Cases. *Journal of Neurology and Psychopathology*, 5:220-26. 1924.

LOREN W. SHAFFER, B.S., M.D., Fellow in Dermatology.

1. The Effect of Hydrogen-Ion Concentration on the Precipitation of Colloidal Benzoin and Gold Solutions by Cerebrospinal Fluid. *Journal of Laboratory and Clinical Medicine*, 9:757-65. 1924.

2. Asymptomatic Neurosyphilis Developing during Systematic Treatment. *Archives of Dermatology and Syphilology*, 10:209-13. 1924.

3. (With J. H. Stokes.) Results Secured by Standard Methods of Treatment in Four Hundred Five Cases of Neurosyphilis. *Journal of the American Medical Association*, 83:1826-34. 1924.

4. Valves As Factors in Venipuncture. *Collected Papers of the Mayo Clinic and the Mayo Foundation*. Philadelphia: Saunders, 16:1015-16. 1924.

ALBERT M. SNELL, B.S., M.D., Assistant in Medicine.

1. (With C. H. Greene and W. Walters.) Clinical and Experimental Studies in Diseases of the Liver. I. A Survey of Tests for Hepatic Function. *Archives of Internal Medicine*. (In press.)

2. (With C. H. Greene, W. Walters, and L. G. Rowntree.) Clinical and Experimental Studies in Diseases of the Liver. II. A Comparative Study of Certain Tests for Hepatic Function in Experimental Obstructive Jaundice. (In press.)

3. Hepatic Functional Tests in Experimental Jaundice. *Minnesota Medicine*, 8:139-42. 1925.

4. (With P. S. Hench and C. H. Greene.) Clinical and Experimental Observations on the Intravenous Use of the Mercurochrome. *Collected*

*Papers of the Mayo Clinic and the Mayo Foundation.* Philadelphia: Saunders. 16:1081-83. 1924.

5. (With P. S. Hench and C. H. Greene.) The Excretion of Mercuriochrome in the Bile. *Ibid.*, 16:160-61. 1924.

GEZA DE TAKÁTS, M.D., Rockefeller Foundation Fellow.

Chemotherapy with Rivanol (2 Aethoxy—6.9 Diamino-Acridine). *Surgery, Gynecology, and Obstetrics.* (In press.)

Study of the function of bone marrow. (To be published from Budapest.)

J. F. WEIR, B.A., M.D., M.S. in Medicine, Assistant in Medicine.

The Thyroxin and Tryptophane Content of the Diseased Thyroid Gland, and the Iodin Compounds in Desiccated Thyroid. *American Journal of the Medical Sciences*, 169:860-65. 1925.

LOUIS F. X. WILHELM, B.A., M.D., Fellow in Dermatology.

1. Duodenal Lavage in the Treatment of Jaundice Complicating the Treatment for Syphilis. *Archives of Dermatology and Syphilology*, 10: 499-506. 1924.

2. (With J. H. Stokes.) Tryparsamid in the Treatment of Neurosyphilis: a Study Based on Observation of 152 Patients for Eighteen Months. *Ibid.*, 11:579-610. 1925.

## OBSTETRICS

ROBERT D. MUSSEY, M.D., Associate Professor of Obstetrics.

1. (With L. M. Randall.) Hypertension: an Index to the Toxemia of Pregnancy. *Minnesota Medicine*, 7:583-86. 1924.

2. Clinical Similarity between Eclamptic Toxemia and Acute Glomerulonephritis. *American Journal of Obstetrics*, 9:808-19. 1925.

3. Eclampsia, with Unusual Nonprotein Nitrogen Retention in the Blood: Report of a Case. *Ibid.* (In press.)

LEDA J. STACY, M.D., Assistant Professor of Medicine.

Treatment of Carcinoma of the Body of the Uterus. *Radiological Review.* (In press.)

LAWRENCE M. RANDALL, M.D., Fellow in Obstetrics.

1. Vaginocopy in the Treatment of Gonorrheal Infection of the Lower Genital Tract in Infants and Young Girls. *American Journal of Obstetrics and Gynecology*, 8:345-51. 1924.

2. Acute Hydramnios and Homologous Triplets. *Ibid.*, 8:766-70. 1924.

3. Tubal Inflation in a Case of Sterility. *Medical Clinics of North America*, 8:1137-43. 1925.

4. The Weight Factor in Pregnancy. *American Journal of Obstetrics and Gynecology*, 9:529-35. 1925.



5. (With R. D. Mussey.) Hypertension: an Index to the Toxemia in Pregnancy. *Minnesota Medicine*, 7:583-86. 1924.
6. Observations on Dry Labor. *Minnesota Medicine*. (In press.)

## OPHTHALMOLOGY AND OTO-LARYNGOLOGY

WILLIAM L. BENEDICT, M.D., Professor of Ophthalmology.

1. Treatment of Uveal Diseases. *Journal of the Indiana State Medical Association*, 17:408-14. 1924.
2. Etiology and Treatment of Scleritis and Episcleritis. *Transactions of the American Academy of Ophthalmology and Otolaryngology*. 1924. (In press.)
3. Bony Tumors of the Orbit. *Ohio State Medical Journal*. (In press.)

HAROLD I. LILLIE, B.A., M.D., Professor of Otology, Rhinology, and Laryngology.

1. (With F. W. Kranz.) A Quantitative Study of Hearing with and without Cotton Plug Protheses in the Middle Ear. *Annals of Otology, Rhinology, and Laryngology*, 33:458-71. 1924.
2. (With J. B. Stevens.) Staphylococcus Septicemia Secondary to Mastoiditis and Sigmoid Sinus Thrombosis. Operation and Recovery: Report of Case. *Archives of Otolaryngology*, 1:283-85. 1925.
3. Osteomyelitis of the Cranial Bones Secondary to Paranasal Sinus Operations. *Annals of Otology, Rhinology, and Laryngology*. (In press.)
4. (With W. I. Lillie.) Choked Discs in Association with Surgical Mastoid Disease without Apparent Intradural Involvement. *American Otolological Society*. (In press.)
5. The Unsatisfactory Effects of Postoperative Irrigation in Certain Cases of Chronic Suppurative Paranasal Sinusitis. *American Laryngological, Rhinological, and Otolological Society*. (In press.)
6. The Effect of Environment on the Upper Respiratory Tract. *Minnesota Medicine*. (In press.)
7. Pain Syndromes Following Intranasal Operative Procedures. *Annals of Otology, Rhinology, and Laryngology*. (In press.)
8. (With C. M. Anderson.) Certain Diagnostic Problems in Otology. *Surgical Clinics of North America*. (In press.)

GORDON B. NEW, D.D.S., M.D., Professor of Rhinology, Laryngology, and Stomatology.

1. (With P. P. Vinson.) Metastasis from Symptomless Cancer of the Esophagus. *Medical Journal and Record*, 120:19-20. 1924.
2. The Roentgenologic Diagnosis of Pathologic Conditions of the Jaw. *Radiology*, 3:165-67. 1924.
3. Nasal Deformities. *Minnesota Medicine*, 7:629-33. 1924.

4. (With F. A. Figi.) Treatment of Fibromas of the Nasopharynx: Report of Thirty-two Cases. *American Journal of Roentgenology*, 12: 340-43. 1924; *Annals of Otology, Rhinology, and Laryngology*, 34:191-86. 1925.

5. (With F. A. Figi.) Value of the Roentgen Ray in Diagnosis of Tumors of the Jaw. *Journal of the American Medical Association*, 83: 1555-58. 1924.

6. (With F. A. Figi.) The Use of Full Thickness Skin Grafts. *Minnesota Medicine*, 7:714-16. 1924.

7. The Treatment of Malignant Tumors of the Pharynx and Nasopharynx. *Surgery, Gynecology, and Obstetrics*, 40:177-82. 1925.

8. Unusual Pharyngeal Lesions. *Archives of Otolaryngology*, 1:384-91. 1925.

9. (With P. A. O'Leary.) Pemphigus from the Laryngologist's Standpoint. *Archives of Otolaryngology*. (In press.)

10. The Treatment of Malignant Tumors of the Nose, Throat, and Mouth. *Kansas City Clinical Society Quarterly Bulletin*, 1:23-27. 1925.

11. Plastic Surgery of the Nose. *Surgical Clinics of North America*. (In press.)

BERT E. HEMPSTEAD, B.A., M.D., Assistant Professor of Oto-Laryngology.

(With S. F. Adams.) Diabetes in the Practice of Otolaryngology. *Archives of Otolaryngology*, 1:181-85. 1925.

WALTER I. LILLIE, M.D., M.S. in Ophthalmology, Instructor in Ophthalmology.

1. Tryparsamide Treatment of Syphilis of the Central Nervous System. Observations from an Ophthalmologic Standpoint. *Journal of the American Medical Association*, 83:809-13. 1924.

2. Ocular Phenomena in Acromegaly. *American Journal of Ophthalmology*, 8:32-39. 1925.

3. Ocular Phenomena Produced by Temporal Lobe Tumors. (In press.)

4. (With H. I. Lillie.) Choked Discs in Association with Surgical Mastoid Disease without Apparent Intradural Involvement. *Transactions of the American Otolological Society*. (In press.)

HENRY P. WAGENER, B.S., M.D., M.S. in Ophthalmology, Instructor in Ophthalmology.

1. (With N. M. Keith.) Cases of Marked Hypertension, Adequate Renal Function and Neuroretinitis. *Archives of Internal Medicine*, 34: 374-87. 1924; *Transactions of the Association of American Physicians*, 39:39-44.

2. (With J. F. Gipner.) Coloboma of the Iris, Choroid, and Optic Disc, with Detachment of the Retina. *American Journal of Ophthalmology*. (In press.)

WALTER J. DECKER, B.S., M.D., Fellow in Oto-Laryngology.

The following problem is under investigation:

(With G. B. New.) Pharyngeal Sinus Due to Pott's Disease of Cervical Spine. A Study of Cases of Cervical Pott's Disease from 1910 to 1925.

FRED A. FIGI, M.D., Fellow in Oto-Laryngology.

1. (With G. B. New.) Treatment of Fibromas of the Nasopharynx: Report of Thirty-two Cases. *American Journal of Roentgenology*, 12:340-43. 1924; *Annals of Otology, Rhinology, and Laryngology*, 34:191-96. 1925.

2. (With G. B. New.) Value of the Roentgen Ray in Diagnosis of Tumors of the Jaw. *Journal of the American Medical Association*, 83:1555-58. 1924.

3. (With G. B. New.) The Use of Full Thickness Skin Grafts. *Minnesota Medicine*, 7:714-16. 1924.

4. Bare Radium Tubes in the Treatment of Tumors around the Head and Neck. *Minnesota Medicine*. (In press.)

MARY S. KNIGHT, B.S., M.D., Fellow in Ophthalmology.

1. Melanotic Neoplasms of the Eye. *Journal of the American Medical Association*, 83:1062-68. 1924.

2. Two Cases of Melanotic Tumor Found in Eyes That Had Been Enucleated Because of Painful Uveitis with Phthisis Bulbi. *Surgical Clinics of North America*, 4:499-501. 1924.

3. A Critical Survey of Neoplasms of the Choroid. *American Journal of Roentgenology*. (In press.)

HENRY F. WILKINSON, B.S., M.D., Fellow in Oto-Laryngology.

1. Polymorphism of Squamous Epithelium. (Under the direction of A. C. Broders.)

2. (With W. W. Sager.) Microscopic Findings of Appendices Left in the Abdomen at Time of First Operation and Subsequently Removed at Second Operation. (Under the direction of W. C. McCarty.)

## PATHOLOGY

LOUIS B. WILSON, M.D., Professor of Pathology and Director of the Mayo Foundation.

1. Necropsies As an Index of Efficiency of Treatment. *Virginia Medical Monthly*, 52:13-18. 1925.

2. Microscopic Examination of Fresh Tissue, and Necropsy Service in Relation to Surgery. *Annals of Surgery*, 81:863-68. 1925.

3. Should We Know the Physical Failings of Our Families? *Minnesota Medicine*. (In press.)

WILLIAM C. MACCARTY, M.S., M.D., Professor of Pathology.

1. Excised Duodenal Ulcers: A Report of Four Hundred and Twenty-five Specimens. *Journal of the American Medical Association*, 83:1894-98. 1924.

2. The Early Diagnosis of Cancer. *Archives of Clinical Cancer Research*, Volume 1. January, 1925.

3. The Classification of Bone Tumors. (In press.)

4. The Cancer Cell and Nature's Defensive Mechanism. *Radiology*. (In press.)

5. The Study of Fresh Tissue As an Aid to Clinical Diagnosis, Treatment, and Prognosis. *Surgical Clinics of North America*. (In press.)

FRANK C. MANN, M.A., M.D., Professor of Experimental Surgery and Pathology.

1. A Physiologic Consideration of the Gall-Bladder. *Journal of the American Medical Association*, 83:829-32. 1924.

2. (With T. B. Magath and J. L. Bollman.) Studies on the Physiology of the Liver. IX. The Formation of Pile Pigment after Total Removal of the Liver. *American Journal of Physiology*, 69:393-409. 1925.

3. (With T. B. Magath.) Die Wirkungen der totalen Leberexstirpation. *Ergebnisse der Physiologie*, 23:212-73. 1924.

4. (With J. L. Bollman.) The Relation of the Gall-Bladder to the Development of Jaundice Following Obstruction of the Common Bile Duct. *Journal of Laboratory and Clinical Medicine*, 10:540-43. 1925.

5. Investigations of the Relation of Anesthesia to Hepatic Function. *Current Researches in Anesthesia and Analgesia*, 4:107-11. 1925.

6. Studies on the Physiology of the Liver. VIII. Effect of Total Removal of the Liver on the Formation of Urea. *American Journal of Physiology*, 69:371-92. 1924.

7. (With T. B. Magath and J. L. Bollman.) Studies on the Physiology of the Liver. X. Uric Acid Following Total Removal of the Liver. *Ibid.*, 72:629-40. 1925.

8. (With J. L. Bollman and P. DePage.) The Effect of Specific Cholecystitis on the Bile-Concentrating Activity of the Gall-Bladder. *Journal of Laboratory and Clinical Medicine*, 10:544-47. 1925.

9. The Chemical and Mechanical Factors in Experimentally Produced Peptic Ulcer. *Surgical Clinics of North America*. (In press.)

HAROLD E. ROBERTSON, B.A., M.D., D.Sc., Professor of Pathology.

1. The Decline in Tuberculosis As Revealed by Post-Mortem Examinations. *Minnesota Medicine*, 7:543-46. 1924.

2. Hospital Deaths. *Hospital Progress*, 5:371-72. 1924.

3. "Endothelioma" of the Pleura. *Journal of Cancer Research*, 8:317-75. 1924.



4. Unusual Features of Carcinoma. *Minnesota Medicine*, 8:1-3. 1925.
5. (With E. H. Hargis.) Duodenal Ulcer: An Anatomic Study. *Medical Clinics of North America*, 8:1065-92. 1925.
6. Our Responsibility to Our Deaths. *Southern Medical Journal*, 18:125-28. 1925.
7. Better Post-Mortem Service. *Journal of Laboratory and Clinical Medicine*, 10:486-90. 1925.
8. Proposed Modification of the Kaiserling Method for Preservation of Specimens for Display Purposes. *Ibid.*, 10:665-67. 1925.
9. Unsolved Problems in the Pathology of Tuberculosis. *Transactions of the National Tuberculosis Association*, 1925. (In press.)

ALBERT C. BRODERS, M.D., M.S., in Pathology, Associate Professor of Pathology.

1. Cancer's Selfcontrol. *Medical Journal and Record*, 121:133-35. 1925.
2. (With P. P. Vinson.) A Case of Squamous-Cell Epithelioma of the Stomach. *Journal of Laboratory and Clinical Medicine*. (In press.)

THOMAS B. MAGATH, M.S., M.D., Ph.D., Associate Professor of Clinical Bacteriology and Parasitology.

1. Ophiotaenia Testudo, a New Species from Amyda Spinifera. *Journal of Parasitology*, 11:44-49. 1924.
2. (With Edna Jackson.) Septicemia Due to the Bacillus of Morgan No. 1. *Medical Clinics of North America*, 8:1381-87. 1925.
3. (With F. C. Mann and J. L. Bollman.) Studies on the Physiology of the Liver. VIII. Effect of Total Removal of the Liver on the Formation of Urea. *American Journal of Physiology*, 69:371-92. 1924.
4. (With F. C. Mann and J. L. Bollman.) Studies on the Physiology of the Liver. IX. The Formation of Bile Pigment after Total Removal of the Liver. *Ibid.*, 69:393-409. 1924.
5. (With F. C. Mann and J. L. Bollman.) Studies on the Physiology of the Liver. X. Uric Acid Following Total Removal of the Liver. *Ibid.*, 72:629-40. 1925.

6. (With B. H. Hager.) The Etiology of Incrusted Cystitis with Alkaline Urine. *Journal of the American Medical Association*. (In press.)

7. (With F. C. Mann.) Die Wirkungen der totalen Leberexstirpation. *Ergebnisse der Physiologie*, 23:212-73. 1924.

JESSE L. BOLLMAN, B.A., M.S., M.B., Instructor in Experimental Pathology.

1. (With F. C. Mann and T. B. Magath.) Studies on the Physiology of the Liver. VIII. Effect of Total Removal of the Liver on the Formation of Urea. *American Journal of Physiology*, 69:371-92. 1924.

2. (With F. C. Mann.) The Relation of the Gallbladder to the Development of Jaundice Following Obstruction of Common Bile Duct. *Journal of Laboratory and Clinical Medicine*, 10:540-43. 1925.

3. (With F. C. Mann and T. B. Magath.) Studies on the Physiology of the Liver. IX. The Formation of Bile Pigment after Total Removal of the Liver. *American Journal of Physiology*, 69:393-409. 1924.

4. (With F. C. Mann and T. B. Magath.) Studies on the Physiology of the Liver. X. Uric Acid Following Total Removal of the Liver. *Ibid.*, 72:629-40. 1925.

5. (With F. C. Mann and P. DePage.) The Effect of Specific Cholecystitis on the Bile-Concentrating Activity of the Gallbladder. *Journal of Laboratory and Clinical Medicine*, 10:544-47. 1925.

6. (With F. C. Mann and C. S. Sheard.) Studies on the Physiology of the Liver. XI. The Extrahepatic Formation of Bilirubin. *American Journal of Physiology*. (In press.)

7. Experimental Observations on Glucose As a Therapeutic Agent. *Surgical Clinics of North America*. (In press.)

The following problems are under investigation (in collaboration with F. C. Mann):

8. The Effect of Complete Removal of the Liver on the Transitory Hyperglycemias.

This study gives information as to the mechanism of the production of the increased sugar content of the blood in various emergency conditions of life, such as excitement, fear, asphyxia, ether and chloroform anesthesia, and adrenalin increases in the body. This problem also is of value in the consideration of carbohydrate metabolism of the body. No hyperglycemia is produced in the dehepatized animal by any of the methods. The liver is responsible for the production of any increase in the sugar content of the blood normally produced by many conditions which add sudden or abnormal strain to the organism.

9. Muscle Glycogen Following Complete Removal of the Liver.

This study is of value in considering the carbohydrate metabolism of the body, since it establishes both the importance of the muscles and of the liver in this connection. The glycogen of the muscles although present in sufficient amounts is not capable of sufficient utilization to maintain life in the absence of the liver. There is a decrease in glycogen content of the muscles following removal of the liver and life may be maintained for some time in the hepatectomized animal by administration of glucose. Glycogen is formed in the muscles of dehepatized dogs in the presence of sufficient glucose. The liver is responsible for the maintenance of the sugar in the blood and the muscles are unable to supplant the liver in this respect. The carbohydrate stores in the muscle are utilized in the production of muscular energy and heat but the liver must maintain glucose supplies sufficient for the survival and the functioning of the vital organs.

10. Amino Acids Following Complete Removal of the Liver.

This work demonstrates the importance of the liver in protein metabolism. After dehepatization the amino acid content of the blood, tissues, and urine are increased. No formation of urea occurs, nor is any carbohydrate formed from the carbon residue of proteins after liver removal. Administration of amino acids to dehepatized animals results only in the increased excretion and accumulation of amino acids in the body,

whereas in the intact animal, urea and glucose are rapidly formed under these conditions. The presence of the liver is essential for deaminization of amino acids in the body.

## II. Creatin-Creatinine Following Complete Removal of the Liver.

The metabolism of creatin-creatinine is not affected by removal of the liver. The liver plays no important rôle in the formation of these substances in the body.

JOHN G. HARDENBERGH, V.M.D., Instructor in Veterinary Science.

1. Diagnosis and Treatment of Diseases of the Skin of Dogs. *Journal of the American Veterinary Medical Association*, 66:313-20. 1924.

2. (With C. F. Schlotthauer.) Demodectic Mange of the Goat and Its Treatment. *Journal of the American Veterinary Medical Association*. (In press.)

The following problems are under investigation:

3. The Pathogenic and Immunologic Significance of *Bacillus Bronchisepticus* on Canine Distemper.

*Results and conclusions to date.*—A large series of animals have been autopsied and cultures made. *Bacillus bronchisepticus* has been found in the lower trachea or bronchi of more than half the cases, but has not been isolated from other organs nor from the heart blood. In the late stages of distemper, *bacillus bronchisepticus* is found only occasionally. To date, this organism has not been found in other laboratory animals affected with diseases of the respiratory tract. We have not been able to reproduce distemper at all consistently in susceptible animals. Our work with the serological reactions is now in progress and conclusions can not be drawn. It would appear, however, that only very low agglutination-titres to *bacillus bronchisepticus* are found in animals having distemper or convalescent from it; also many dogs that have not been exposed to the infection have sera that agglutinate just as highly as those of diseased animals. *Bacillus bronchisepticus* bacteris or vaccines have not affected the mortality rate from distemper when used over long periods of time on all new dogs introduced into the kennels.

4. An Epidemic of Abscess Formation in Otherwise Normal Guinea-Pigs Due to Hemolytic Streptococci.

*Results and conclusions:* To date, some 65 cases have been studied. Sixty-four cases have yielded a gram positive streptococcus, which has marked hemolytic properties; in 63 cases the organism was recovered from the abscess itself in pure culture and once was contaminated by *B. coli*. All organs and the heart blood have been negative in spontaneous cases. Rabbits and guinea-pigs are very susceptible to all strains of the streptococcus; subcutaneous injection produces local necrosis and pus formation with eventual death, usually from bacteremia. Intra-peritoneal injections cause death very quickly in guinea-pigs with general peritonitis as well as a streptococcemia; rabbits succumb to a peritonitis in three to four days. In practically every case, of artificial infection, the organism has been recovered from the local lesion or from the peritoneal exudate or from the heart blood or all three.

5. (With C. F. Schlotthauer.) Bovine Infection Abortion.

6. (With C. F. Schlotthauer.) Diseases of Calves.

7. (With C. F. Schlotthauer.) Fowl Cholera, Bacillary White Diarrhea, and Avian Tuberculosis.

H. O. CAYLOR, B.S., M.D., Assistant in Surgical Pathology.

1. Sarcoma Associated with Ovarian Fibroma. *Annals of Surgery*, 81:674-78. 1925.

2. Epitheliomas in Sebaceous Cysts. *Ibid.* (In press.)

GEORGINE LUDEN, M.D., Ph.D. in Pathology, Assistant in Pathology.

#### Cancer Research.

The object of the work is to demonstrate experimentally the relation of cholesterol metabolism to malignancy. That there is ample evidence of some such relation may be seen from previous publications, *Studies on Cholesterol* I to VI, but many problems remain to be solved. Work in progress.

JAMES W. KERNOHAN, B.S., M.B., B.Ch., D.P.H., Fellow in Pathology.

The Ventriculus Terminalis: Its Growth and Development. (See abstract under Department of Anatomy, Medical School.)

EDWARD H. WILLAN, M.D., Special Student in Pathology.

The following problem has been under investigation:

(With F. C. Mann.) Peritoneal Absorption and Secretion.

### PEDIATRICS

HENRY F. HELMHOLZ, B.S., M.D., Professor of Pediatrics.

1. (With F. Millikin.) An experimental study of therapeutic procedure in pyelocystitis. *American Journal of Diseases of Children*, 28:700-10. 1924.

2. The Pyogenic Infections of the Urinary Passage. *Abt's Pediatrics*, 4:914-37. 1924.

3. The Effect of Change of Reaction on the Growth of *Bacillus Coli* and *Staphylococcus Aureus*. *American Journal of Diseases of Children*, 29:78-85. 1924.

4. (With F. Millikin.) The Kidney: a Filter for Bacteria. 1. The Pressure of Bacteria in the Blood, Kidney, and Urine after Varying Intervals Following Intravenous Injection. *Ibid.*, 29:497-505. 1925.

5. (With Ruth S. Field.) The Kidney: a Filter for Bacteria. 2. The Effect of Diuresis on the Excretion of Bacteria by the Kidney. *Ibid.*, 29:506-12. 1925.

6. (With Ruth S. Field.) The Kidney: a Filter for Bacteria. 3. The Role of Technic on the Apparent Excretion of Bacteria by the Kidney. *Ibid.*, 29:641-44. 1925.

7. (With Ruth S. Field.) The Kidney: a Filter for Bacteria. 4. The Effect of Clamping the Renal Artery or Renal Vein on the Passage of Bacteria in the Urine. *Ibid.* (In press.)

8. (With Ruth S. Field.) The Kidney: a Filter for Bacteria. 5. The Effect of Nephrotoxins on the Kidney Filter for Bacteria. *Ibid.* (In press.)



9. Chronic Ulcerative Colitis in Childhood. *New York State Journal of Medicine*. (In press.)

10. The Acute Changes in the Kidney and Pelvis after Tying the Ureter in Rabbits.

Hemorrhage into the pelvic wall after eight hours increasing in severity and leading to local destruction of the lining membrane of the pelvis; in extreme cases necrosis of almost the entire lining. Marked hemorrhage and inflammatory reaction in the pelvic tissues characterized by filling of all the small vessels adjacent to the pelvis with polymorphonuclear leucocytes. Rapid healing after the third day with sinuses into the peripelvic tissues persisting in one instance to the fourteenth day. Instances showing local areas of necrosis in the kidney parenchyma, and in one case anemic infarct. Work unfinished.

11. The Treatment of Experimental Pyelitis.

The most effective therapeutic agent was urotropin; hexylresorcinol and mercurochrome were less effective.

12. Experimental Pyelitis.

The production of pyelitis in the rabbit by intravenous injection of a colon bacillus isolated from human pyelitis. Over 95 per cent of animals injected with this organism developed pyelitis with or without focal lesions in the kidney parenchyma.

13. The Use of Hexylresorcinol As a Urinary Antiseptic.

SAMUEL AMBERG, M.D., Associate Professor of Pediatrics.

1. The Urine in Infancy and Childhood. *Abt's Pediatrics*, 4:1032-36. 1924.

2. Certain Aspects of Enuresis. *Journal of the American Medical Association*, 83:1300-1304. 1924.

3. Das Verhältnis des Harndrangs zur Blasenkontraktion bei Enuresis der Kinder. *Zeitschrift für Kinderheilkunde*, 38:169-81. 1924.

The following problems are under investigation:

4. (With O. Grob.) The Effect of Atropin on the Bladder.

In some cases it has been found that atropin exercises a definite influence on the contractions of the bladder. Furthermore, the effect of atropin on the initial slowing of the pulse has been especially noted.

5. The Filtration of Protein Solutions.

Some mucin preparations have been found to filter much slower through an alundum crucible of a certain density and at a certain pressure than other protein solutions and slower than serum which contains a much greater protein content and has a much greater viscosity. Urine filters very slowly.

6. Studies on Isolated Jejunal Loops of the Dog.

Contrary to the statement in literature, it has been found that there exists a time relation to feeding, with regard to the amount of secretion. Furthermore, the reaction of the secretion has been found to be around 8.3. The secretion always contains calcium. In addition the content of the fluid in sodium potassium, magnesium, and phosphorus has been determined.

OTTO GROB, M.D., Fellow in Pediatrics.

(With H. F. Helmholtz.) Coagulation and Bleeding Time in the New-born. Rodda method.

Work in progress.

ETHEL R. HARRINGTON, Ph.B., M.D., Fellow in Pediatrics.

(With Irene Sandiford, W. M. Boothby, and H. F. Helmholz.) Basal-Metabolism Rates in Children.

To determine the normal basal metabolic rate of children from the age of 6-16 years. Work in progress.

ROGER L. J. KENNEDY, B.S., M.D., Fellow in Pediatrics.

1. Duodenal Ulcer and Melena Neonatorum. *American Journal of Diseases of Children*, 28:694-99. 1924.

2. The Prognosis of Sequelae of Epidemic Encephalitis in Children. *Ibid.*, 28:158-72. 1924.

3. The Healing of Duodenal Ulcer in Melena Neonatorum. *Ibid.* (In press.)

The following problems have been under investigation:

4. Route of Infection in Pyelitis.

An attempt to show the route of the so-called ascending infection of the kidneys and kidney pelves, resulting in pyelitis (pyelonephritis).

5. Healing Duodenal Ulcer in Newborn Infant.

A case report with pathologic findings of a duodenal ulcer which shows all the characteristics of the healing duodenal ulcers produced experimentally (by Mann).

6. Cretinism: case report.

Treatment instituted at 4½ months of age after diagnosis.

7. Anterior Sacral Meningocele: case report.

8. Syphilitic Osteochondritis.

An X-ray study of epiphyseal ends of femurs from newborn infants, proven syphilitic.

9. See also two studies listed under the Department of Obstetrics and Gynecology, Medical School.

DONALD C. MEBANE, B.A., M.D., Fellow in Pediatrics.

1. The Examination of the School Children of Olmsted County. *American Journal Public Health*, 14:662-72. 1924.

2. Mongolian Idiocy with Teeth of Hutchinson's Type. Report of case. *American Journal of Diseases of Children*, 28:438-39. 1924.

3. The Significance of the Presence of the Nephrogenic Zone of the Kidney in the Normal and the Syphilitic Fetus and the New-born. *Ibid.*, 28:668-77. 1924. (See abstract under the Department of Obstetrics and Gynecology, Medical School.)

MYNIE G. PETERMAN, M.A., M.D., Fellow in Pediatrics.

1. The Ketogenic Diet in the Treatment of Epilepsy: a Preliminary Report. *American Journal of Diseases of Children*, 28:28-33. 1924.

2. The Ketogenic Diet in the Treatment of Epilepsy. *Dietary Administration and Therapy*, 2:462-66. 1924; 4:93-96. 1925.

3. The Ketogenic Diet in the Treatment of Epilepsy: Report of Two Cases. *Medical Clinics of North America*, 8:1351-52. 1925.
4. Brain Abscess: Report of an Unusual Case. *American Journal of Diseases of Children*, 28:208-11. 1924.
5. The Ketogenic Diet in Epilepsy. *Journal of the American Medical Association*. (In press.)

### PHYSIOLOGY AND BIOCHEMISTRY

EDWARD C. KENDALL, Ph.D., Professor of Biochemistry.

1. Chemistry of the Thyroid Gland. *Transactions of the Association of Resident and Ex-Resident Physicians of the Mayo Clinic*, 5:64-66. 1924; *Journal of the American Medical Association*, 83:1166-67. 1924.
2. The Quantitative Study of the Physiologic Action of Thyroxin. *Proceedings of the Society of Experimental Biology and Medicine*, 22:307-8. 1925.
3. The Influence of the Thyroid Gland on Oxidation in the Animal Organism. (In press.)
4. The Influence of Thyroxin and Other Substances on Oxidation in the Animal Organism. (Unfinished.)

CHARLES SHEARD, Ph.D., Professor of Physiologic Optics.

1. Some Theoretical and Practical Points of Interest in Visual Optics. *American Journal of Physiologic Optics*, 5:376-93. 1924.
2. Applications of a Fundamental Mathematical Equation to Ocular Refraction and Ophthalmic Lenses. *American Journal of Ophthalmology*, 7:597-602. 1924.
3. On the Effects of Quantity and Quality of Illumination upon the Human Eye and Vision. *American Journal of Physiological Optics*, 5:468-85. 1924.
4. Instantaneous Photomicrography of the Skin Capillaries in the Living Human Body. *Science*, 60:409-10. 1924.
5. Illumination and Its Effects on the Human Eye. *Nation's Health*, 6:316-20. 1924.
6. Some Fundamental Principles of Modern Ophthalmic Lenses. *American Journal of Physiological Optics*, 6:32-48. 1925.
7. Note on the Subjective Observation of the Blood Corpuscles in the Retinal Capillaries. *Journal of the Optical Society of America and Review of Scientific Instruments*. (In press.)
8. On the Chromatic Aberration of the Eye and the Chromatic Variations in the Interval of Strum As Determined by a Subjective Method of Skiascopy. *Ibid.* (In press.)
9. On the Development of a Subjective Method of Skiascopy. *Ibid.* (In press.)

10. (With G. E. Brown.) A Method for Instantaneous Photomicrography of the Skin Capillaries. *Journal of Laboratory and Clinical Medicine*. (In press.)

IRENE SANDIFORD, Ph.D., Instructor in Physiologic Chemistry.

1. (With Ethel R. Harrington.) Preliminary Report on the Basal Metabolism of 157 Normal School Children between the Ages of Five and Seventeen Years. *Proceedings of the American Society of Biological Chemists*, 63:35-37. 1924.

2. (With T. Wheeler.) The Basal Metabolism before, during and after Pregnancy. *Journal of Biological Chemistry*, 62:329-52. 1924.

3. Estimation of the Surface Area of the Fetus and a Graphic Comparison of the Various Surface Area Formulas. *Journal of Biological Chemistry*, 62:323-28. 1924.

4. (With W. M. Boothby, K. Sandiford, and J. Slosse.) The Effect of Thyroxin on the Respiratory and Nitrogenous Metabolism of Normal and Myxedematous Subjects. I. A Method of Studying the Reserve or Deposit Protein, with a Preliminary Report of the Results Obtained. *Transactions of the Association of American Physicians*. (In press.)

5. Surface Area. I. Estimation of the Surface Area of the Fetus. II. Graphic Comparison of the Various Surface Area Formulas. *Journal of Biological Chemistry*, 62:323-28. 1924.

MARY WHELAN, M.A., Fellow in Physiologic Chemistry.

1. The Effect of Intravenous Injection of Inorganic Chlorids on the Composition of Blood and Urine. *Journal of Biological Chemistry*, 63:585-620. 1925.

2. (With C. W. Barrier and N. M. Keith.) Treatment of Nephritis and Edema with Calcium. *Journal of the American Medical Association*, 83:666-70. 1924; *Dietary Administration and Therapy*. 2:554-62. 1924.

3. (With N. M. Keith.) The Effect of Novasurol on the Composition of Blood and Urine. *American Journal of Physiology*, Volume 72, 1925.

4. (With N. M. Keith and C. W. Barrier.) The Diuretic Action of Ammonium Chlorid and Novasurol in Cases of Nephritis with Edema. *Journal of American Medical Association*. (In press.)

## RADIOLOGY

RUSSELL D. CARMAN, M.D., Professor of Roentgenology.

1. (With V. S. Counseller.) A Preliminary Report on the Radiologic Diagnosis of Cholecystic Disease by the Graham Method. *Transactions of the Section on Gastroenterology and Proctology of the American Medical Association*, pages 77-84. 1924.

2. (With S. Fineman.) The Roentgenologic Diagnosis of Diaphragmatic Hernia, with a Report of Seventeen Cases. *Radiology*, 3:26-45. 1924.



3. (With K. S. Davis.) Roentgenologic Evidence of Spinal-Cord Tumors: Report of Three Cases. *Ibid.*, 3:185-88. 1924.

4. (With V. S. Counseller.) Roentgenologic Diagnosis of Cholecystic Disease with the Aid of the Sodium Salt of Terbromphenolphthalein. *American Journal of Roentgenology*, 12:403-13. 1924.

5. (With A. Miller.) Occupational Hazards of the Radiologist, with Special Reference to Changes in the Blood. *Radiology*, 3:408-17. 1924.

6. Technical Aids in the Roentgenologic Demonstration of Lesions High in the Stomach and on the Posterior Wall. *Ibid.*, 4:33-39. 1925.

7. (With W. F. Braasch.) The Pyelographic and Roentgenologic Diagnosis of Renal Tumors. *Ibid.*, 4:445-52. 1925.

8. The Roentgenologic Diagnosis of Peptic Ulcer. *Journal of the American Medical Association*, and *Texas State Journal of Medicine*. (In press.)

9. (With H. W. Meyerding and J. D. Garvin.) Metastasis to the Bones from Carcinoma of the Breast: a Roentgenologic Study. *Radiology*. (In press.)

10. The Roentgenologic Diagnosis of Disease of the Gallbladder. *Ibid.* (In press.)

11. Cholecystography in Its Application to the Diagnosis of Cholecystic Disease. Read before the International Congress of Radiology, London, July 1-4, 1925.

ALEXANDER B. MOORE, M.D., Associate Professor of Roentgenology.

Bladder Sensibility. *Archives of Surgery*, 9:176-87. 1924.

HARRY H. BOWING, B.S., M.D., Instructor in Radiology.

1. Significant Cellular Changes Observed in Irradiated Tissue, Especially in Cancer of the Rectum. *Radiology*, 4:378-83. 1925.

2. (With J. H. Bliss.) The Value of Definite Methods of Treatment of Malignant and Nonmalignant Conditions. *Medical Clinics of North America*, 8:1353-70. 1925.

3. A Radiotherapeutic Method of Treating Carcinoma of the Cervix Uteri. *Radiology*. (In press.)

4. (With P. P. Vinson.) Surgical Diathermy for Tumors of the Trachea. *American Bronchoscopic Society*. (In press.)

ARTHUR U. DESJARDINS, M.D., M.S. in Radiology, Instructor in Radiology.

1. Dermatology and Radiology. *Urological and Cutaneous Review*, 28:383-84. 1924.

2. L'État Actuel de la Thérapie par les Rayonnements dans le Cancer. *Archives Médicales Belges*, 77:557-70. 1924.

3. The Reaction of Abdominal Tumors to Radiation. *Journal of the American Medical Association*, 83:109-13. 1924.

4. (With F. L. Smith.) Radiodermatitis and Its Treatment. *New Orleans Medical and Surgical Review*, 77:177-83. 1924.

5. (With Ann Kelley.) Diathermy: History, Use, Indications. *Hospital Management*, 18:48-49. 1924.

6. Anatomic Cross-Section Charts of the Average Male and Female Figures. *Transactions of the Association of Resident and Ex-Resident Physicians of the Mayo Clinic*, 5:55-58. 1924.

7. Radiotherapy in Four Unusual Cases of Malignant Tumor. *Medical Clinics of North America*, 8:1371-79. 1925.

8. Pleuropneumonitis Following X-Ray Treatment, and Diffuse Metastasis to the Lungs from Cancer of the Breast. *Radiology*, 4:265-72. 1925.

9. Direct or Indirect Biologic Effects. *Ibid.*, 4:432-33. 1925.

10. Radiotherapy and Diathermy in Blastomycosis. *American Journal of Roentgenology*. (In press.)

11. Common Misconceptions in Radiotherapy. *Surgery, Gynecology, and Obstetrics*. (In press.)

ALBERT MILLER, B.A., M.D., Instructor in Radiology.

1. (With R. D. Carman.) Occupational Hazards of the Radiologist, with Special Reference to Changes in the Blood. *Radiology*, 3:408-17. 1924.

2. (With R. D. Carman.) A Book on the Roentgenologic Diagnosis of Diseases of the Chest. (Unfinished.)

CHARLES G. SUTHERLAND, M.B., Instructor in Roentgenology.

1. Shadows of Calcified Areas in the Bony Pelvis. *Radiology*, 3:69-73. 1924.

2. Report of Case of Myxoma of the Lung. *Ibid.*, 3:161. 1924.

3. Report of Case of Giant Colon with Impacted Feces in the Sigmoid. *Ibid.*, 3:259-60. 1924.

4. Osteochondromatosis in the Hip-Joint: Report of a Case. *Ibid.*, 3:285. 1924.

5. A Radiologic Study of Soft-Tissue Tumors. *Ibid.*, 3:420-24. 1924.

6. Appendiceal Abscess with Concretions around a Pin. *Ibid.*, 2:316. 1924.

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8. Miliary Calcification in the Lung. *Medical Clinics of North America*, 8:1273-86. 1925.

9. Calcified Areas in the Abdominal Cavity: Report of Six Cases. *Radiology*, 4:130-33. 1925.

10. Charcot's Joints. *Ibid.*, 4:355-63. 1925.

11. Niches on the Greater Curvature of the Stomach: Reports of Two Cases. *Ibid.* (In press.)

ROY KEGERREIS, Assistant in Physics.

Apparatus for the Calibration of X-Ray Machines. *Radiology*, 3:141-44. 1924.

JOHN D. CAMP, B.S., M.D., Fellow in Roentgenology.

1. The Normal and Pathologic Anatomy of the Sella Turcica As Revealed by Roentgenograms. *American Journal of Roentgenology*, 12:143-56. 1924.

2. A New Type of X-Ray Film Clip. *Radiology*, 3:163. 1924.

3. Osteoma of the Sphenoid Bone and Dural Endothelioma. *American Journal of Roentgenology and Radium Therapy*, 11:523-24. 1924.

KENNETH S. DAVIS, B.S., M.D., Fellow in Roentgenology.

1. Pulmonary Fibrosis. *Radiology*, 3:150-57. 1924.

2. Intrathoracic Changes Following X-Ray Treatment: a Clinical and Experimental Study. *Ibid.*, 3:301-22. 1924.

3. (With R. D. Carman.) Roentgenologic Evidence of Spinal-Cord Tumors: Report of Three Cases. *Ibid.*, 3:185-88. 1924.

## SURGERY

DONALD C. BALFOUR, M.D., Professor of Surgery and Chief of the Department of Surgery.

1. Recent Advances in Surgery. *International Clinics*, 2:171-89. 1924.

2. The Case against Gastro-Enterostomy. *Journal of the American Medical Association*, 83:603-6. 1924.

3. Gastric Surgery. *Transactions of the Association of Resident and Ex-Resident Physicians of the Mayo Clinic and Mayo Foundation*, 5:63-64. 1924.

4. Value of Co-operation between Internist and Surgeon in the Management of Complicated Gastric Conditions, with Some Remarks on Partial Gastrectomy. *Journal of the American Medical Association*, 84:876-79. 1925.

5. The Relative Merits of the Various Treatments of Peptic Ulcer. *Minnesota Medicine*, 8:218-24. 1925.

6. The Sequelae of Gastro-Enterostomy: the Indications for Disconnecting the Anastomosis, and the Technic of the Operation. *Annals of Surgery*. (In press.)

7. The Management of Lesions of the Stomach and Duodenum. *Surgical Clinics of North America*. (In press.)

WILLIAM F. BRAASCH, B.S., M.D., Professor of Urology.

1. Differential Diagnosis in Diseases of the Urinary Tract. *Medical Clinics of North America*, 8:1109-24. 1925.

2. Data with Regard to Lesions of the Nerves of the Urinary Tract. *Journal of Urology*, 13:383-98. 1925.

3. Clinical Data in Cases of Renal Lithiasis. *Illinois Medical Journal*, 47:284-87. 1925.

4. (With R. D. Carman.) The Pyelographic and Roentgenologic Diagnosis of Renal Tumors. *Radiology*, 4:445-52. 1925.

5. (With H. C. Bumpus.) A Simple Table for Cystoscopy and Roentgenography. *Journal of Urology*, 13:247-50. 1925.

6. Possible Errors in the Clinical Interpretation of Laboratory Data. Read before the Springfield Academy of Medicine, Springfield, Massachusetts, November 11, 1924.

7. Clinical Data in Cases of Nephrolithiasis. *Illinois Medical Journal*, 47:284-87. 1925.

8. (With H. C. Bumpus.) Clinical Results with Intravenous Chemotherapy in Urinary Infections. *Transactions of the American Association of Genito-Urinary Surgeons*. (In press.)

MELVIN S. HENDERSON, M.D., F.A.C.S., Professor of Orthopedic Surgery.

1. Surgery in Cases of Tuberculous Arthritis. *Journal-Lancet*, 44:411-16. 1924.

2. Fractures of the Hip. *Minnesota Medicine*, 7:786-91. 1924.

3. Arthroplasty. *Ibid.*, 8:97-103. 1925.

4. Pseudarthrosis of the Tibia in Children. *Journal of Bone and Joint Surgery*, 7:340-54. 1925.

5. (With H. E. Simon.) Brodie's Abscess. *Archives of Surgery*, 9:504-15. 1924.

6. Mobilization of Stiff Joints. *Surgical Journal*. (In press.)

7. Surgical Treatment of Lesions of the Hip and Knee and Nonunion of the Radius. *Surgical Clinics of North America*. (In press.)

8. Ununited Fractures. *Journal of the American Medical Association*. (In press.)

9. (With P. N. Jepson.) Treatment Following Orthopedic Surgery. In Bartlett's Postoperative Care of Surgical Patients. (In press.)

EDWARD S. JUDD, M.D., Professor of Surgery.

1. (With A. J. Scholl.) Renal Calculus. *Texas State Journal of Medicine*, 20:434-39. 1924.

2. Stricture of the Common Bile Duct. *Surgery, Gynecology, and Obstetrics*, 39:832-33. 1924.

3. (With B. R. Parker.) Gastro-jejunal Ulcer. *Oxford Surgery*, 50:1060-75. 1924.

4. (With V. G. Burden.) Postoperative Stricture of the Common Bile Duct. *Annals of Surgery*, 80:210-16. 1924.



5. (With L. W. Pollock.) Diverticulitis of the Colon. *Ibid.*, 80:425-38. 1924.

6. Problems Encountered in the Treatment of Disease of the Biliary Tract. *Minnesota Medicine*, 7:161-70. 1924.

7. The Surgical Treatment of Cancer of the Breast. *American Journal of Roentgenology*, 13:411-14. 1925.

8. Gastric and Duodenal Ulcers. *Wisconsin State Medical Journal*. (In press.)

9. (With V. G. Burden.) Benign Stricture of the Bile Ducts. *Archives of Surgery*. (In press.)

10. (With V. G. Burden.) Internal Biliary Fistula. *Annals of Surgery*, 81:305-12. 1925.

11. The Surgical Treatment of Cancer. *Journal of the American Medical Association*, 84:10-13. 1925.

12. (With O. S. Proctor.) Multiple Gastric Ulcers. *Medical Journal and Record*, 121:93-95. 1925.

13. Clinical Demonstration: Affections of the Colon and Urinary Tract. *Journal-Lancet*, 45:90-91. 1925.

14. Infections of the Gall-Bladder and Bile-Ducts. *Journal-Lancet*, 45:179-82. 1925.

15. (With V. G. Burden.) Obstructive Jaundice. *American Journal of the Medical Sciences*, 169:888-96. 1925.

16. (With L. D. Keyser, G. S. Foulds, J. Verbrugge, and A. J. Scholl.) A Review of Urologic Surgery. *Archives of Surgery*, 10:774-812. 1925.

17. Certain Difficulties Presented by Disease of the Biliary Tract. *Surgical Clinics of North America*. (In press.)

18. (With B. R. Parker and H. D. Morse.) Urinary and Prostatic Calculi. *Ibid.* (In press.)

19. (With B. R. Parker and H. D. Morse.) Tumors of the Kidney and Ureter and Tuberculosis of the Kidney. *Ibid.* (In press.)

20. Surgical Procedures in Jaundiced Patients. *Journal of the American Medical Association*. (In press.)

21. Partial Resection of the Kidney. *Annals of Surgery*. (In press.)

22. (With H. D. Morse.) Carcinoma of the Male Breast. *Surgery, Gynecology, and Obstetrics*. (In press.)

CHARLES H. MAYO, M.A., LL.D., M.D., D.Sc., F.A.C.S., Professor of Surgery.

1. Tuberculosis and Its Transmission. *Proceedings of the United States Live Stock Sanitary Association*, pages 143-46. 1924.

2. (With W. Walters.) The Two-Stage Mikulicz Operation for Cancer of the Sigmoid. *Surgery, Gynecology, and Obstetrics*, 39:1-4. 1924.

3. Appendix and Abdominal Diseases. *Journal of the American Medical Association*, 83:592-93. 1924.

4. Hour-Glass Stomach and Duodenum. *Annals of Surgery*, 81:313-21. 1925.
5. Infection and Its Relation to General and Local Diseases. *Illinois Medical Journal*, 47:274-76. 1925.
6. Gallstones and Diseases of the Gallbladder. *Annals of Surgery*, 81:955-60. 1925.
7. Focal Infection. *Journal of the American Dental Association*, 1925.
8. Methods of Ureteral Repair and Transplantation. *Annals of Surgery*, 1925.
9. (With H. S. Plummer.) The Results of Iodin Administration in Exophthalmic Goiter. *Transactions of the American Surgical Association*. 1925.
10. The Modern Viewpoint of Infections. (In press.)
11. (With W. A. Hendricks.) The Thyroid Gland. (In press.)
12. Ulcer of the Stomach and Duodenum. *Surgical Clinics of North America*. (In press.)

WILLIAM J. MAYO, M.D., Sc.D., LL.D., F.A.C.S., F.R.C.S., Regent of the University of Minnesota.

1. The Surgical Treatment of Hepatic Cirrheses. *Annals of Surgery*, 80: 419-24. 1924.
2. Certain Blood Dyscrasias Dependent on Pathologic Conditions of the Spleen. *Journal of the American Medical Association*, 83:815-18. 1924.
3. Cancer of the Uterus. *Surgery, Gynecology, and Obstetrics*, 39:511-12. 1924.
4. Masters of Surgery in the Early Years of the Annals of Surgery. *Annals of Surgery*, 81:3-8. 1925.
5. Specialization in Surgery. *Ibid.*, 10:264-66. 1925.
6. The Relative Values of Surgery and Radiotherapy. *Minnesota Medicine*, 8:7-10. 1925.
7. Les Fonctions Végétatives Chez l'Homme et Leur Coördination. *Archives Médicales Belges*, 77:1049-56. 1924.
8. The Physiology and Pathology of the Blood in Relation to Surgery. *Journal of the Michigan State Medical Society*, 1925.
9. The Relation of the Spleen to Certain Chronic Purpuras. *Surgery, Gynecology, and Obstetrics*, 40:771-75. 1925.
10. (With W. Walters.) Abnormal Function of the Liver. *Journal of the American Medical Association*. (In press.)
11. Filtration Phenomena in Relation to Clinical Medicine. *Surgical Clinics of North America*. (In press.)

JOHN L. CRENSHAW, M.D., Associate Professor of Urology.

Observations on Neoplastic Tumors of the Bladder. *Transactions of the American Association of Genito-Urinary Surgery*. (In press.)

BOYD S. GARDNER, D.D.S., Associate Professor of Dental Surgery.

1. Postoperative X-Ray Examination in Dentistry. *Radiology*, 3:74-75. 1924; *Dental Summary*, 44:870-72. 1924.
2. Extraction of Teeth, with Special Reference to Co-operation between Exodontist and General Practitioner. *Journal of the American Dental Association*, 11:732-34. 1924.
3. A Method of Localizing Roots of Teeth, Residual Granulomas or Foreign Bodies. *Radiology*, 3:254-55. 1924.
4. The X-Ray As a Means of Safeguarding the Antrum of Highmore during Extraction of Teeth. *Ibid.*, 3:507-8. 1924.
5. Extraction of Teeth. Amount of Surgery Feasible at One Time, and Treatment in Acute Cases. *Dental Cosmos*. (In press.)
6. The Relation of the Roentgen Ray to the Newer Methods of Extraction. *Radiology*. (In press.)
7. Presidential Address. *Journal of the American Dental Association*. (In press.)

HENRY W. MEYERDING, M.D., M.S. in Orthopedic Surgery, Associate Professor of Orthopedic Surgery.

1. X-Ray Findings in Bone Tumors: Exostosis, Chondromas, Bone Cysts, Osteitis Fibrosa Cystica, Giant Cell Tumors. *Radiology*, 3:216-21. 1924.
2. Benign Foreign Body Giant-Cell Tumors in the Long Bones. *Journal of the American Medical Association*, 83:1323-29. 1924.
3. Roentgenographic Types of Sarcoma of the Long Bones. *Radiology*, 3:457-63. 1924.
4. Multiple Myeloma. *Radiology*. (In press.)
5. Surgical Treatment of Chronic Lesions of the Bone. *Surgical Clinics of North America*. (In press.)
6. Bone Tumors. *Minnesota Medicine*. (In press.)
7. (With R. D. Carman and J. D. Garvin.) Metastasis to the Bones from Carcinoma of the Breast: a Roentgenologic Study. (In press.)  
The following problems are under investigation:
8. (With A. C. Broders.) Sarcoma of the Bone with the View of Differentiating the Endotheliomas, Formerly Classed As Round Celled Sarcoma of the Perithelial Type.
9. Exostoses, Both Single and Multiple, with the View of Determining the Recurrence, X-Ray Characteristics, Bones Involved, Etc.

WALTER E. SISTRUNK, Phm.G., M.D., Associate Professor of Surgery.

1. The Reduction of Surgical Mortality. *New Orleans Medical and Surgical Journal*, 77:63-68. 1924.
2. The Treatment of Cancer of the Colon. *Journal of the Michigan State Medical Society*, 24:28. 1925.

3. Carcinoma of the Cecum and Ascending Colon. *Surgical Clinics of North America*. (In press.)

4. Hirschsprung's Disease. *Ibid.* (In press.)

5. Methods of Avoiding and Treating Complications Following Gastro-Enterostomy. (In press.)

ALFRED W. ADSON, M.D., M.A., M.S. in Surgery, Assistant Professor of Surgery.

1. The Surgical Treatment of Glossopharyngeal Neuralgia. *Archives of Neurology and Psychiatry*, 12:487-506. 1924.

2. A Clinical Discussion of Ramisection. *Minnesota Medicine*, 8:275-77.

3. Diagnosis and Treatment of Tumors of the Spinal Cord. *Archiv Franco-Belgium Chirurgie*. (In press.)

4. The Neuralgias. *Textbook of Medicine by American Authors*. (In press.)

5. (With H. L. Parker.) Compression of the Spinal Cord and Its Roots by Hypertrophic Osteoarthritis. Diagnosis and Treatment. *Surgery, Gynecology, and Obstetrics*. (In press.)

6. (With G. E. Brown.) Treatment of Raynaud's Disease by Lumbar Sympathetic Neurectomy. *Journal of the American Medical Association*. (In press.)

7. (With G. E. Brown.) Calorimetric Studies of the Extremities Following Lumbar Sympathectomy. *American Journal of Medical Sciences*. (In press.)

8. Ramisection for Spastic Paralysis. *Surgical Clinics of North America*. (In press.)

HERMON C. BUMPUS, JR., Ph.B., M.D., M.S. in Urology, Assistant Professor of Urology.

1. Radium in the Treatment of Benign Hypertrophy of the Prostate. *Journal of Urology*, 12:63-70. 1924.

2. Urinary Reflux. *Ibid.*, 12:341-46. 1924.

3. Modern Methods and Results of Treating Malignancy of the Bladder. *Journal of the American Medical Association*, 83:1139-42. 1924.

4. Ureteral Scissors. *Ibid.*, 83:1331. 1924.

5. Pyelonephritis Treated with Mercurochrome. *Medical Clinics of North America*, 8:1103-7. 1925.

6. (With W. F. Braasch.) A Simple Table for Cystoscopy and Roentgenography. *Journal of Urology*, 13:247-50. 1925.

7. Treatment of Infections of the Urinary Tract. *Journal-Lancet*, 45:99-105. 1925.

8. Unusual Dilatation of the Urethra with Valve Formation. *Journal of Urology*, 13:551-53. 1925.



9. The Elimination of Foci of Infection As a Means of Prolonging Life. *Medical Insurance*. (In press.)

10. Radium and Roentgen Ray in the Treatment of Sarcoma of the Prostate. *Journal of Urology*. (In press.)

11. Pyelonephritis. *Wisconsin Medical Journal*. (In press.)

12. (With W. F. Braasch.) Clinical Results with Intravenous Chemotherapy in Urinary Infections. *Transactions of the American Association of Genito-Urinary Surgery*. (In press.)

13. (With A. J. Scholl.) Ureteral Stones. *Surgical Clinics of North America*. (In press.)

The following problems are under investigation:

#### 14. Median Prostatic Operation.

The results obtained by removing the median portion of the prostate gland through the urethra in preference to doing a complete prostatectomy when the the median portion of the gland alone is causing the obstruction. All cases comprising several hundred so treated in the past have been collected and information will be obtained as to whether their obstructing symptoms were completely relieved by this surgical procedure or whether they later had a recurrence of the symptoms and a subsequent prostatectomy was necessary. If the operation proved only palliative, for how long did it last.

#### 15. Cancer of the Prostate.

The author has also collected a thousand cases of cancer of the prostate seen at the Mayo Clinic and intends to establish some clinical facts as to how frequently it occurs, how long the duration of the disease is when untreated, the age at which it occurs, it being interesting to note that no cases have occurred below the age of 42 and only two below the age of 45. It will also be possible with this large series to establish the relative percentage of metastasis to the spine, glands, bones, etc.

CARL A. HEDBLUM, M.A., M.D., Ph.D in Surgery, Assistant Professor of Surgery. (Now Professor of Surgery, University of Wisconsin.)

1. The Treatment of Non-tuberculous Pulmonary Suppuration. *Minnesota Medicine*, 7:668-69. 1924.

2. The Surgical Treatment of Acute Pulmonary Abscess and Chronic Pulmonary Suppuration with Special Reference to the Post-Tonsillectomy Type. *Journal of the American Medical Association*, 83:1577-81. 1924.

3. Recent Progress in Thoracic Surgery. *Wisconsin Medical Journal*, 23:278-82. 1924.

4. The Evolution of Thoracic Surgery As a Specialty. *Archives of Surgery*, 10:267-77. 1925.

VERNE C. HUNT, B.S., M.D., M.S. in Surgery, Assistant Professor of Surgery.

1. Factors of Safety in Prostatic Surgery. *Journal of the Iowa State Medical Society*, 14:450-53. 1924.

2. Perinephritic Abscess. *Journal of the American Medical Association*, 83:2070-74. 1924.

3. Surgery of the Lower Urinary Tract. *Illinois Medical Journal*, 47:222-27. 1925.

4. Bilocular Diverticulum of the Urinary Bladder. *Surgical Clinics of North America*. (In press.)

5. Suprapubic Prostatectomy and Its Postoperative Management. *Ibid.* (In press.)

6. (With W. P. Herbst.) False Diverticulum of the Duodenum Containing Gallstones, with Cholecystdiverticular Fistula. *Ibid.* (In press.)

7. (With L. D. Powell.) Malignant Disease of Bartholin's Gland. *Ibid.* (In press.)

8. Suprapubic Prostatectomy. Medical Society of the State of California. (In press.)

9. The Relationship of the Clinical Pathologist to Surgical Practice. *California Medical Association Journal*. (In press.)

10. Disposal of the Ureter in Surgical Excision of Malignant Tumors of the Bladder. *Journal of Urology*. (In press.)

11. Relationship of Preliminary Treatment to Mortality Rate in Suprapubic Prostatectomy. *Arkansas State Medical Association Journal*. (In press.)

HUGH T. JONES, B.A., M.D., M.S. in Orthopedic Surgery, Instructor in Orthopedic Surgery.

1. Loose Body Formation in Synovial Osteochondromatosis, with Special Reference to the Etiology and Pathology. *Transactions of the Association of Resident and Ex-Resident Physicians of the Mayo Clinic*, 5:37-40. 1924.

The following problems are under investigation:

2. Congenital Club Foot in Infancy.

3. (With Wm. McK. Craig.) Sciatica.

JAMES C. MASSON, M.D., Assistant Professor of Surgery.

1. A Case of True Hermaphroditism. *American Journal of Obstetrics and Gynecology*, 9:81-86. 1925.

2. Sacrococcygeal Sinuses and Cysts. *Surgical Clinics of North America*. (In press.)

3. Acute Inversion of the Uterus. *Ibid.* (In press.)

JOHN DE J. PEMBERTON, B.A., M.D., M.S. in Surgery, Assistant Professor of Surgery.

1. Surgery of the Thyroid. *Transactions of the Association of Resident and Ex-Resident Physicians of the Mayo Clinic*, 5:67-68. 1924.

2. Notes on the Technical Difficulties of Surgery of the Thyroid Gland. *Surgical Clinics of North America*. (In press.)

3. Problems in Goiter Surgery. *Dallas Medical Journal*. (In press.)

STUART HARRINGTON, M.D., M.S. in Surgery, Instructor in Surgery.

(With A. G. Plankers.) Empyema. *Surgical Clinics of North America*. (In press.)

GEORGE M. HIGGINS, M.A., Ph.D., Instructor in Experimental Surgery.

1. The Lymphatic System of the Newborn Rat, *Mus norvegicus albinus*. *Anatomical Record*. (In press.)

2. The Jugular Lymph Sac in the Albino Mouse. *American Journal of Anatomy*. (In press.)

### 3. Morphogenesis of the Gall-bladder.

Studies are being made upon the morphogenesis of the biliary tract in white rats and white mice: the gall-bladder is absent in adults of the former, but present in those of the latter. This morphogenetic approach to the problem of gall-bladder physiology is undertaken to determine: (1) what light, if any, embryological processes may shed upon the characteristics of the adult biliary tract; (2) whether or no a gall-bladder as such exists at any time in the developing body of the white rat; (3) the divergent functions, if such exist, in such divergent biliary tracts; (4) the characteristic differentiations of the portal units of these two types of hepatic organizations. As yet the investigation has not progressed sufficiently far to warrant the statement of any definite results.

FREDERICK L. SMITH, B.A., M.D., Instructor in Surgery.

(With A. U. Desjardins.) Radiodermatitis and Its Treatment. *New Orleans Medical and Surgical Review*, 77:177-83. 1924.

WILLIAM H. VON LACKUM, B.S., M.D., Instructor in Urology.

1. (With J. K. Holloway.) Latent Prostatitis and Focal Aspects. *Medical Journal and Record*. (In press.)

The following problems have been under investigation:

2. Numerous Phases of General Medicine from the Standpoint of Prostatic Sepsis.

3. (With A. C. Nickel.) Bacteriologic Studies of Various Body Foci, with Particular Relation to Determining the Origin of Hematogenous Prostatitis.

4. (With A. C. Nickel.) Extensive Studies in Experimental Arthritis, Using Growths of Bacteria from Prostatic Secretions.

### 5. Animal Elective Localization.

Studies of streptococci cultured from prostatic secretions have been carried out with the production of numerous general infectious conditions, many of them corresponding anatomically to the lesion in the human.

6. Studies on Bacteriology of Endocervicitis, with Particular Reference to Its Focal Rôle.

WALTMAN WALTERS, M.D., M.S., in Surgery, Instructor in Surgery.

1. Surgical Significance of Hepatic Function. *Transactions of the Association of Resident and Ex-Resident Physicians of the Mayo Clinic*, 5:97-100. 1924; *Minnesota Medicine*, 8:146-49. 1925.

2. The Preoperative Preparation of Handicapped Surgical Patients. *Annals of Surgery*, 79:803-5. 1924.

3. (With J. P. Bowler.) Preoperative Preparation of Patients with Obstructive Jaundice. An Experimental Study of the Toxicity of Intravenous Calcium Chloride Used in the Preparation of Patients. *Surgery, Gynecology, and Obstetrics*, 39:200-206. 1924.

4. Preoperative Preparation of the Handicapped Surgical Patient. *Surgical Journal*, 30:244-45. 1924.

5. (With C. H. Mayo.) The Two-Stage Mikulicz Operation for Cancer of the Sigmoid. *Surgery, Gynecology, and Obstetrics*, 39:1-4. 1924.

6. (With J. P. Bowler.) The Effect of Intravenous Injections of Calcium Chlorid on the Kidney. *Journal of the American Medical Association*, 83:1232-36. 1924.

7. (With J. P. Bowler.) The Toxicity and Rate of Excretion of Calcium Chlorid from the Blood-Stream. *Annals of Surgery*, 80:545-50. 1924.

8. (With W. J. Mayo.) Abnormal Function of the Liver. *Journal of the American Medical Association*. (In press.)

9. (With L. G. Rowntree, C. H. Greene, and C. S. McVicar.) Clinical and Experimental Studies in Diseases of the Liver. III. A Comparative Study of Certain Tests for Hepatic Function in Patients with Obstructive Jaundice. *Archives of Internal Medicine*. (In press.)

10. (With L. G. Rowntree, C. H. Greene, and C. S. McVicar.) Clinical and Experimental Studies in Diseases of the Liver. IV. Functional Tests in Cases of Carcinoma of the Liver and Biliary Tract. *Archives of Internal Medicine*. (In press.)

The following problems have been under investigation:

11. (With A. M. Kilgore and J. L. Bollman.) Chemical Changes Accompanying Clinical Experimental Duodenal Fistulae.

12. Study of Blood Coagulation Effect of Extracts of the Liver (Heparin) on Blood Coagulability.

13. (With W. A. Hendricks.) The Effect of Rest in Bed upon the Blood Pressure and Blood Chemistry of Surgical Patients.

LAUNCELOT M. BLACKFORD, B.S., M.D., Fellow in Surgery.

1. (With J. K. Holloway.) Comparison of the Blood-Platelet Count in Splenic Arterial and Venous Blood. *American Journal of Medical Science*, 168:723-28. 1924.

2. The Study of Epithelial Hyperplasia of the Prostate.

From one to ten sections from several hundred glands removed at autopsy are being studied.

WINFRED H. BUEERMANN, B.S., M.D., Fellow in Surgery.

The following problems are under investigation:

1. A Clinical and Pathological Study of Carcinomatous Gastric Ulcers.

The study will include all carcinomatous gastric ulcers which have come to surgery during the five-year period, 1920-24 inclusive. The purpose is to derive statistical data concerning the carcinomatous gastric ulcers seen during the period and will include a study of the previous gastric complaint with reference to the ulcer-cancer sequence seen in this group of cases.

A review of the gross pathological specimens has been made and blocks cut from various points in the ulcer to determine (1) the grade of malignancy dealt with and attempt to establish some relationship between the grade and the clinical course of this group, and (2) whether a primary carcinoma of the stomach ulcerating and a gastric ulcer with carcinomatous degeneration can be pathologically distinguished.

2. A Study of Duodenal Ulcers with Achlorhydria.

The study includes all cases of duodenal ulcer, surgically treated up to 1925, in which a previous achlorhydria existed. A study has been made of the clinical symptoms, preoperative clinical diagnoses, X-ray diagnoses, operative procedures, and postoperative courses. A group of duodenal ulcers with achlorhydria subjected to medical treatment during the year 1924, is studied for comparison.

3. A Study of Blood Chemistry Changes Following Various Types of Operation on the Stomach.

The object is to establish a normal basis for the study of changes in blood chemistry following various types of operations on the stomach. The blood urea, plasma CO<sub>2</sub>, and plasma chlorides were taken on the third, sixth, and ninth days on fifty successive cases upon whom some type of gastric surgery was performed. For comparison blood studies were made on fifty patients who had had other types of abdominal surgery done. This will determine a base line for the study of the changes seen in the toxic states associated with pyloric and upper intestinal obstruction as is occasionally seen postoperatively.

VERNE G. BURDEN, M.D., M.S. in Surgery, Fellow in Surgery.

1. True Bilateral Hermaphrodism with Periodic Hematuria. *Journal of Urology*, 12:153-58. 1924.

2. (With E. S. Judd.) Postoperative Stricture of the Common Bile Duct. *Annals of Surgery*, 80:210-16. 1924.

3. (With E. S. Judd.) Benign Stricture of the Bile Ducts. *Archives of Surgery*. (In press.)

4. (With E. S. Judd.) Internal Biliary Fistula. *Annals of Surgery*, 81:305-12. 1925.

5. (With E. S. Judd.) Obstructive Jaundice. *American Journal of Medical Sciences*, 169:888-96. 1925.

6. Observations on the Histologic and Pathologic Anatomy of the Hepatic, Cystic, and Common Bile Ducts. *Annals of Surgery*. (In press.)

JOHN G. BURNS, B.A., M.D., Fellow in Surgery.

1. Aseptic End-to-End Anastomosis of the Intestine. *Annals of Surgery*, 81:670-73. 1925.

2. (With C. F. Dixon and H. Z. Giffin.) Observations on Pernicious Anemia Following Ileostomy. *Transactions of the Association of American Physicians, and Journal of American Medical Association*. (In press.)



C. HOPE CARLTON, M.B., M.Ch., F.R.C.S., Special Student in Anesthesia.

Regional Anesthesia: An Estimate of Its Place in Practice. *British Medical Journal*, No. 3353, 648-51. 1925.

WINCHELL MCK. CRAIG, B.A., M.D., Fellow in Surgery.

The following problems are under investigation:

1. (With A. W. Adson.) Pain Associated with Neurofibromatosis.
2. Spinal Cord Tumors.

Analysis of cases in the light of pathological, clinical, and surgical findings.

JOHN M. CULLIGAN, B.S., M.D., M.S. in Urology, Fellow in Urology.

1. (With M. P. Omohundro.) Advantages of Direct Cystoscopy. *Minnesota Medicine* 8:368-71. 1925.
2. Phleboliths. *Journal of Urology*. (In press.)

JOHN L. DIES, B.S., M.D., Fellow in Surgery.

Primary Carcinoma of the Kidney. *Surgery, Gynecology, and Obstetrics*, 40:499-501. 1925.

CLAUDE F. DIXON, B.S., M.D., Fellow in Surgery.

(With J. G. Burns and H. Z. Giffin.) Observations on Pernicious Anemia Following Ileostomy. *Transactions of the Association of American Physicians. Journal of the American Medical Association*. (In press.)

HANS O. FOUCAR, B.A., M.D., Fellow in Surgery.

(With J. C. Masson.) The Use of Zinc Chlorid in Gynecology. *American Journal of Obstetrics and Gynecology*. (In press.)

JOHN G. FRAWLEY, B.A., M.D., C.M., Fellow in Surgery.

1. Perineal Testicle: Report of a Case. *American Journal of Diseases of Children*, 29:513-15. 1925.
2. Congenital Webbing. *Ibid.*, 29:799-805. 1925.

EARLE I. GREENE, B.S., M.D., Fellow in Surgery.

The Cytology of Bone Tumors.

A study of several hundred specimens removed at operation, grossly and microscopically. The clinical interpretation of pathological detail. Problem under investigation.

L. J. GREENWALD, D.D.S., Special Student in Dental Surgery.

(With R. W. Matchett.) Technique of Culturing the Interior of Extracted Teeth.

Problem has been under investigation.

BENJAMIN H. HAGER, B.S., M.D., Fellow in Urology.

1. The Clinical Value of Vital Staining. *Journal of Laboratory and Clinical Medicine*, 9:738-42. 1924.
2. (With T. B. Magath.) The Etiology of Incrusted Cystitis with Alkaline Urine. *Journal of the American Medical Association*. (In press.)

EMIL D. HAUSER, B.S., M.D., Fellow in Orthopedic Surgery.

1. (With T. P. Noble.) Acute Bone Atrophy. *Archives of Surgery*. (In press.)
2. (T. P. Noble.) Coxa Vara. *Ibid.* (In press.)

JACKSON K. HOLLOWAY, B.A., M.D., Fellow in Surgery.

1. (With L. M. Blackford.) Comparison of the Blood-Platelet Count in Splenic Arterial and Venous Blood. *American Journal of Medical Sciences*, 168:723-28. 1924.
2. (With W. H. von Lackum.) Chronic Prostatitis with Special Reference to Its Focal Aspects. *Medical Journal and Record*. (In press.)
3. (With H. Z. Giffin.) A Review of Twenty-eight Cases of Purpura Hemorrhagica with Splenectomy. *American Journal of Medical Sciences*. (In press.)

PAUL N. JEPSON, B.A., M.D., Fellow in Orthopedic Surgery.

1. A Splint for Abduction, Traction, and Suspension in Fracture of the Humerus. *Journal of the American Medical Association*, 84:674-75. 1925.
2. Apparatus for the Transference of Patients. *Minnesota Medicine*. (In press.)
3. An Arthroplasty Splint. *Surgery, Gynecology, and Obstetrics*. (In press.)
4. (With M. S. Henderson.) Treatment Following Orthopedic Surgery. In Bartlett's Postoperative Care of Surgical Patients. (In press.)
5. Volkman's Ischaemic Contracture.

To try to prove mechanism and pathology by which the contractures take place. Problem under investigation.

JOHN D. KOUCKY, B.S., M.D., M.S. in Surgery, Fellow in Surgery.

Ovarian Dermoids. A study of one hundred consecutive cases. *Annals of Surgery*, 81:821-32. 1925.

JAMES K. LATCHFORD, B.A., M.B., Fellow in Surgery.

(With H. E. Robertson.) Epithelial and Other Changes in the Thyroid Gland.

To determine the incidence of epithelial changes and possible significance and relationship to various diseases. Gross and microscopic studies from 500 autopsies of persons without hyperthyroidism reveal high incidence of adenoma (40 per cent) and of hypertrophy. Work unfinished.

JOHN S. LUNDY, B.A., M.D., Assistant in Anesthesia.

1. The Comparative Value of Ethylene As an Anesthetic. *Journal of the American Medical Association*, 83:350-55. 1924.
2. The Administration of Ethylene-Oxygen. *Iowa State Medical Journal*. (In press.)
3. Splanchnic Block. *Surgical Clinics of North America*. (In press.)

4. An Easy Method of Inducing Local Anesthesia for Simple Amputation of the Breast. *Journal of the American Medical Association*. (In press.)

JOHN H. LYONS, M.S., M.D., Fellow in Surgery.

1. Linitis Plastica. *Surgery, Gynecology, and Obstetrics*, 39:34-38. 1924.

2. (With E. S. Judd.) Surgery of the Stomach. *Surgical Clinics of North America*, 4:319-24. 1924.

LOUIS D. MCGUIRE, B.S., M.D., Fellow in Surgery.

Drainage of the Thoracic Duct in Peritonitis. *Surgery, Gynecology, and Obstetrics*, 40:626-30. 1925.

R. W. MATCHETT, D.D.S., L.D.S., Special Student in Dental Surgery.

The following problems have been under investigation:

1. (With A. C. Nickel.) Studies in Elective Localization of Bacteria from Cultures of Pulpless Teeth.

2. (With L. J. Greenwald.) Technique of Culturing the Interior of Extracted Teeth.

3. Bacteriology of the Pulpless Tooth.

ALBERT L. MAYFIELD, B.S., M.D., Fellow in Surgery.

Papillary Cystadenoma of the Ovary.

Attempt is made to show the relationship of the size of the tumor, intracystic or extracystic tumor, ruptured or unruptured tumor, and implantations to the length of life. Work unfinished.

WILLIAM R. MEEKER, B.S., M.D., Fellow in Surgery.

1. (With Mary Hines.) Anesthesia at the Mayo Clinic. *British Journal of Anesthesia*, 2:13-35. 1924.

2. (With A. J. Scholl.) Sacral Nerve Block Anesthesia. The Anatomy Involved, Technic and Clinical Applications. *Annals of Surgery*, 80:739-72. 1924.

3. Splanchnic Anesthesia: an Analysis of Forty-two Cases. *Archives of Surgery*, 10:699-719. 1925.

J. G. MEISSER, D.D.S., Special Student in Dental Surgery.

Further Studies on Elective Localization of Bacteria from Infected Teeth. *Journal of the American Dental Association*, 12:554-65. 1925.

STANLEY H. MENTZER, M.D., Fellow in Surgery.

1. Methods of Preparing Gallbladders and Calculi for Study and Museum Display. *International Association of Medical Museums Bulletin*, 11:37-40. 1925.

2. The Pathogenesis of Biliary Calculi. Read before the American Association of Pathologists and Bacteriologists, Washington, D.C., May, 1925.

GUNTHER W. NAGEL, B.A., M.D., Fellow in Surgery.

Unusual Conditions in the Duodenum and Their Significance. (Membranous obstruction of the lumen, diverticula and carcinoma). *Archives of Surgery*. (In press.)

THOMAS P. NOBLE, M.B., M.D., F.R.C.S., Assistant in Orthopedic Surgery.

1. Adolescent Coxa Vara. *Annals of Surgery*, 80:773-78. 1924.
2. Myositis Ossificans: A Clinical and Radiological Study. *Surgery, Gynecology, and Obstetrics*, 39:795-802. 1924.
3. Pseudocoxalgia. *Journal of Bone and Joint Surgery*, 7:70-84. 1925.
4. (With E. D. Hauser.) Acute Bone Atrophy. *Archives of Surgery*. (In press.)
5. (With E. D. Hauser.) Coxa Vara. *Ibid.* (In press.)

MILES P. OMOHUNDRO, M.D., Fellow in Urology.

(With J. M. Culligan.) Advantages of Direct Cystoscopy. *Minnesota Medicine*, 8:368-71. 1925.

BENNETT R. PARKER, B.S., M.D., Fellow in Surgery.

1. (With E. S. Judd.) Gastro-jejunal Ulcer. *Oxford Surgery*, Oxford University Press, Volume I, Part 2:106-75. 1924.
2. (With E. S. Judd and H. D. Morse.) Urinary and Prostatic Calculi. *Surgical Clinics of North America*. (In press.)

JAMES CRAIG POTTER, B.A., M.D., Fellow in Surgery.

A Mechanical Method for Recording Small Variations in Pressure and Volume. *Journal of Laboratory and Clinical Medicine*, 9:648-50. 1924.

OSCAR S. PROCTOR, B.A., M.D., Fellow in Surgery.

1. Chronic Peptic Ulcer in Children. *Surgery, Gynecology, and Obstetrics*. (In press.)
2. (With E. S. Judd.) Multiple Gastric Ulcers. *Medical Journal and Record*, 121:93-95. 1925.

WILLIAM W. SAGER, B.A., M.D., Fellow in Surgery.

1. The Effect of Lugol's Solution on the Histological Picture of Exophthalmic Goiters. (Work under the direction of L. B. Wilson.)

To establish or disprove the presence of histological changes following giving of Lugol's solution to exophthalmic goiter.

2. (With H. F. Wilkinson.) Microscopic Findings of Appendices Left in the Abdomen at Time of First Operation and Subsequently Removed.

To establish the fact that the routine removal of appendices in any intra-abdominal operation when conditions permit is not only justifiable but mandatory.

ALBERT J. SCHOLL, B.A., M.D., M.S. in Urology, Fellow in Urology.

1. Tumors Involving the Dome of the Bladder. *Journal of the American Medical Association*, 83:1147-52. 1924.

2. (With G. S. Foulds.) Squamous-Cell Tumors of the Renal Pelvis. *Annals of Surgery*, 80:594-605. 1924.
3. (With E. S. Judd, L. D. Keyser, G. S. Foulds, and J. Verbrugge.) A Review of Urologic Surgery. *Archives of Surgery*, 10:774-812. 1925.
4. (With E. S. Judd.) Renal Calculus. *Texas State Journal of Medicine*, 20:434-39. 1924.
5. (With E. S. Judd.) A Review of Cases of Hydronephrosis and Pyonephrosis. *Surgical Clinics of North America*, 4:425-49. 1924.
6. (With W. R. Meeker.) Sacral Nerve Block Anesthesia: the Anatomy Involved, Technic, and Clinical Application. *Annals of Surgery*, 80:739-72. 1924.
7. (With E. S. Judd, L. D. Keyser, G. S. Foulds, and J. Verbrugge.) A Review of Urologic Surgery. *Archives of Surgery*. (In press.)
8. (With H. C. Bumpus.) Ureteral Stones. *Surgical Clinics of North America*. (In press.)

THEODORE S. SWAN, B.S., M.D., Fellow in Surgery.

1. Report of a Case of Lymphosarcoma of the Cecum. *Radiology*. (In press.)
2. Polyposis Localized in the Transverse Colon. Report of a Case. *Ibid.*, 4:55-57. 1925.
3. Fibromyxoma of the Stomach Projecting into the Duodenum. *Ibid.*, 4:430-31. 1925.
4. (With G. B. Eusterman and D. M. Berkman.) Primary Carcinoma of the Duodenum: Report of Fifteen Verified Cases. *Annals of Surgery*. (In press.)

JEAN VERBRUGGE, M.D., C. R. B. Foundation Fellow.

1. (With E. S. Judd, L. D. Keyser, G. S. Foulds, and A. J. Scholl.) A Review of Urologic Surgery. *Archives of Surgery*, 10:774-812. 1925.
2. Gastrojejunal Colic Fistulas. *Ibid.* (In press.)
3. (With A. J. Scholl, E. S. Judd, L. D. Keyser, and G. S. Foulds.) A Review of Urologic Surgery. *Ibid.* (In press.)

RILEY M. WALLER, B.A., M.D., Fellow in Surgery.

The following problem has been under investigation:

The Calorigenic Action of the Various Homologues of Adrenalin.

THOMAS O. YOUNG, B.S., M.D., Fellow in Surgery.

A Consideration of Postoperative Complications Following Thyroidectomy. *Minnesota Medicine*, 7:514-19. 1924.





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